CONFIDENTIAL

MEMORANDUM

To:

Case: 59411 Date: March 22, 1955 Page: 1

25X1

Subject: Temperature Trials

Three groups of 20 mechanisms were calibrated by four runs at room temperature (75°F.). Each group of mechanisms was then subjected to three runs at each of a series of test temperatures ranging from -40°F. to 160°F. The conditions of the tests are described elsewhere. At the end of each run, the timing error was recorded. These data are tabulated in the Appendix to this memorandum. In what follows, we discuss conclusions which can be drawn from an analysis of these data.

I Average Error as a Function of Temperature

The average timing error calculated for all runs and all mechanisms at each temperature is shown in Table I, together with the standard deviation of the distribution of individual results around this mean. The standard deviation is a measure of the uniformity of the results. As will be shown below, the distribution of errors is satisfactorily represented by the normal (Gaussian) distribution function. For such distributions, approximately 68% of the results lie within one standard deviation on either side of the mean value.

The data from Table I are plotted in Figure I. Notice that at temperatures of zero and above, the mean is essentially constant (at -1 minute) and the standard deviation does not vary appreciably from 8.5 minutes. At -30°, the average error has dropped to approximately -17 minutes and at -40°, the average error is approximately -24 minutes. At the same time, the standard deviation of the distribution of individual errors around this mean has increased to 12 and 17 minutes respectively, indicating a wider spread in the results.

The initial calibration runs at room temperature showed a fairly wide distribution of results for each mechanism. Therefore, we have computed the results of each of the test runs as the change in timing error from the average on the calibration runs. That is, we have subtracted from each of the results the average error for each mechanism at 75°F. These results are shown in Table II and in Figure II. Notice that the same general results are shown as were shown in the plot of the raw data.

The mechanisms in Group 3, for the high temperature runs, were apparently more erratic in their behavior than the mechanisms in the other two groups. There appears to be a drop of about 5 minutes in the average error for temperatures 120° and above. This drop is due almost entirely to mechanisms number 03, 08, and 36 which showed a high average error on the calibration runs but which settled down to a very small error during the test runs. When the results for these three mechanisms are omitted in the analysis, there is no apparent change in the average timing

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TABLE I

AVERAGE TIMING ERRORS

Group	Temperature (°F.)	Mean Timing Error (Minutes)	Standard Deviation (Minutes)
I	75°	-1.87	7.45
	30°	-0.58	5.99
	0°	-2.32	8.59
	-30°	-17.10	11.79
	-40°	-24.22	17.20
II	75°	+1.00	6.08
	50°	+2.22	8.36
	100°	-0.50	8.23
III	75°	+1.54	15.60
	120°	-1.79 wrong	9.22
	140°	-2.23	9.67
	160°	-1.55	9.15
Averages: All Runs		-2.19	11.10
Calibration Runs (75°F.)		+0.02	8.57
Test Runs		-3.48	11.55
Test Runs 0°F. and Above		-0.98	8.46

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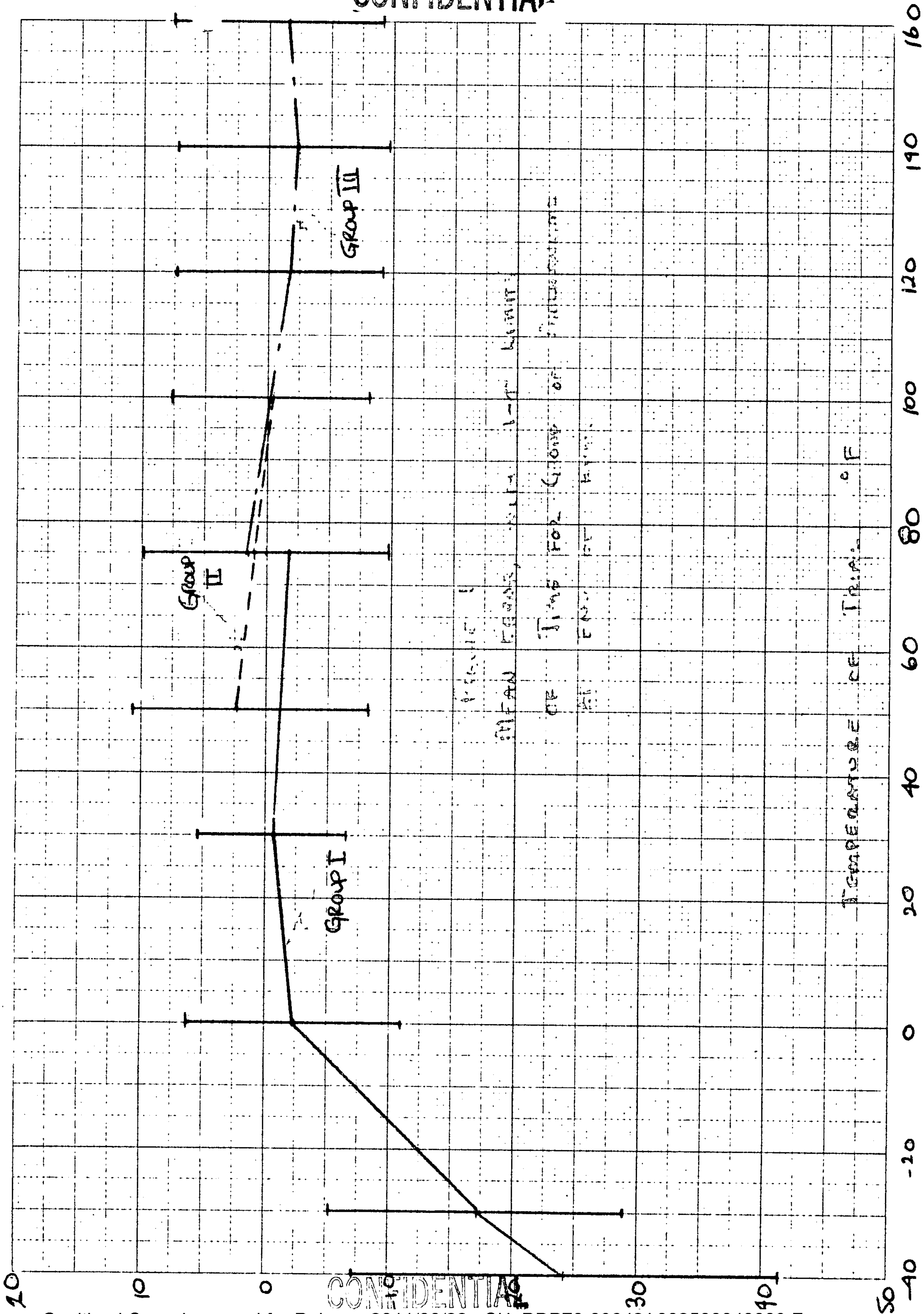

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TABLE II

AVERAGE CHANGE IN TIMING ERROR FROM AVERAGE OF CALIBRATION RUNS

Group	Temperature °F.	Mean Change Minutes	Standard Deviation Minutes
I	30°	+0.79	4.97
	0°	-0.33	8.87
	-30°	-16.33	10.25
	-40°	-23.76	11.57
II	50°	-0.29	9.40
	100°	-1.48	9.45
III (All Mechanisms)	120°	-5.70	8.18
	140°	-5.44	8.85
	160°	-5.35	12.03
III (Except Nos. 03, -8, 36)	120°	-1.30	3.15
	140°	-0.55	3.27
	160°	+0.88	6.08

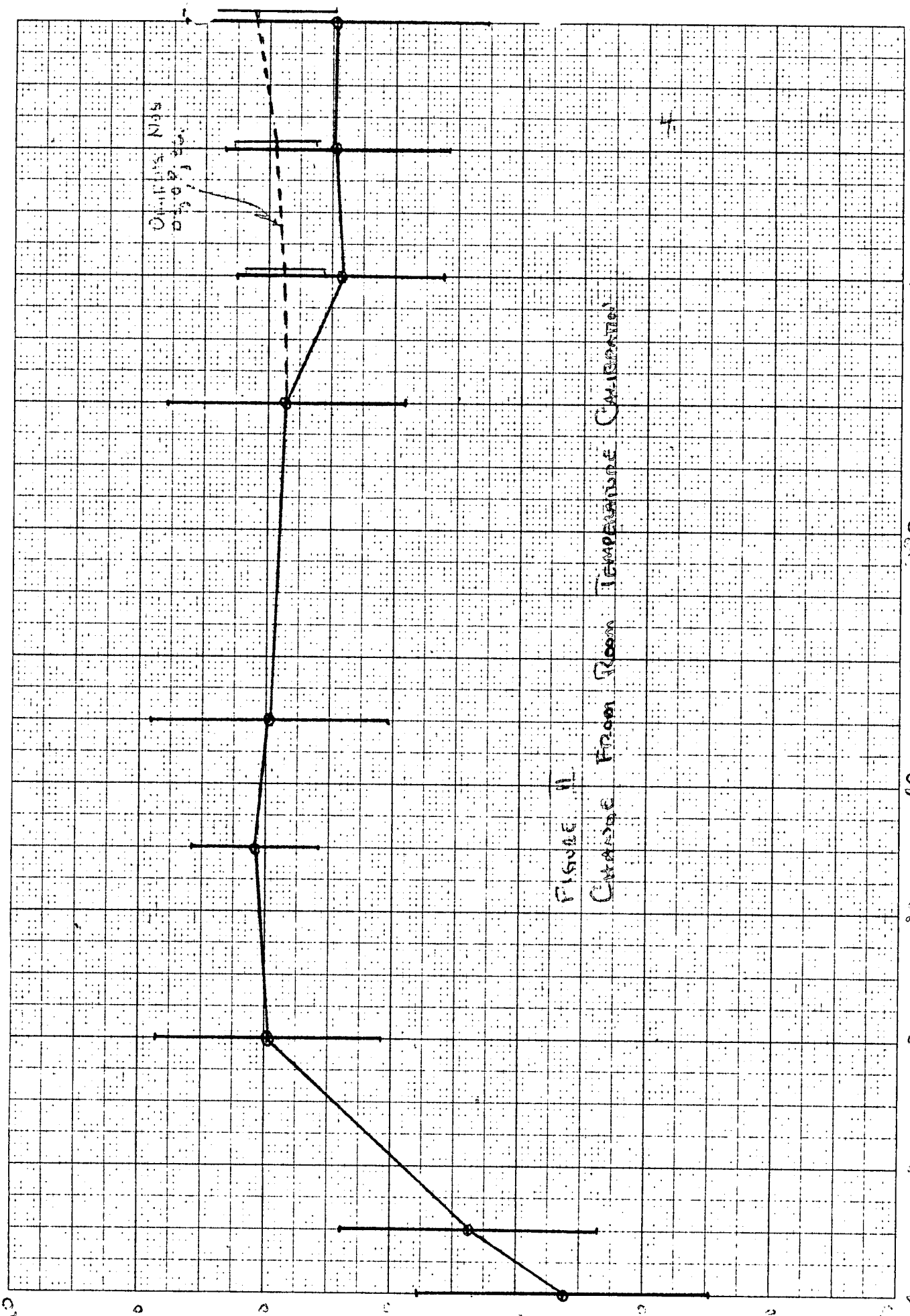


FIGURE 11
Change From Room Temperature Calibration

Subject: Temperature Trials

Conclusion

There is no detectable effect of temperature on timing errors for temperatures between 0° and 160°F. There is a marked drop in the value of the average error at temperatures below 0°, accompanied by a significant increase in the dispersion of errors around their mean value.

II Reproducibility

It will be noted that whereas the average error at room temperature ranges from -26 to + 22 minutes, for the various mechanisms, the errors on repeated runs for any one mechanism generally lie within a minute or two of each other.

Conclusion

The results obtained on these tests are significant in that repetitions tend to reproduce results which are much closer together than the difference between errors for different mechanisms.

III Accuracy

As was noted above, the mean timing error at temperature above 0° is approximately -1 minute. The standard deviation is approximately 8.5 minutes. This means that approximately 68% of all results lay between -9.5 minutes and + 7.5 minutes.

In order to illustrate more completely the distribution of results, we have plotted in Figure III the distribution of error for all mechanisms on the four calibration runs at room temperature. The horizontal axis of this graph is the error in minutes. The vertical axis is the percentage of all mechanism-runs for which the error was less than or equal to the error shown on the horizontal axis. The scale used on the vertical axis is such that a normal (Gaussian) distribution would be plotted as a straight line. Notice that the data cluster about the line quite well.

In Figure IV we have plotted a similar distribution for the errors on test runs for temperatures 0° and above. The distribution of errors is the same on these test runs as it was at room temperature.

Conclusion

The timing errors at temperatures above 0° are approximately normally distributed with a mean approximately -1 minute and a standard deviation approximately 8.5 minutes. Thus, it is to be expected that 68% of the time the error at the end of an operating run would be within 8.5 minutes on either side of the correct time. Approximately 95% of the time results would fall within 17 minutes either side of the correct value.

Fr

STAT

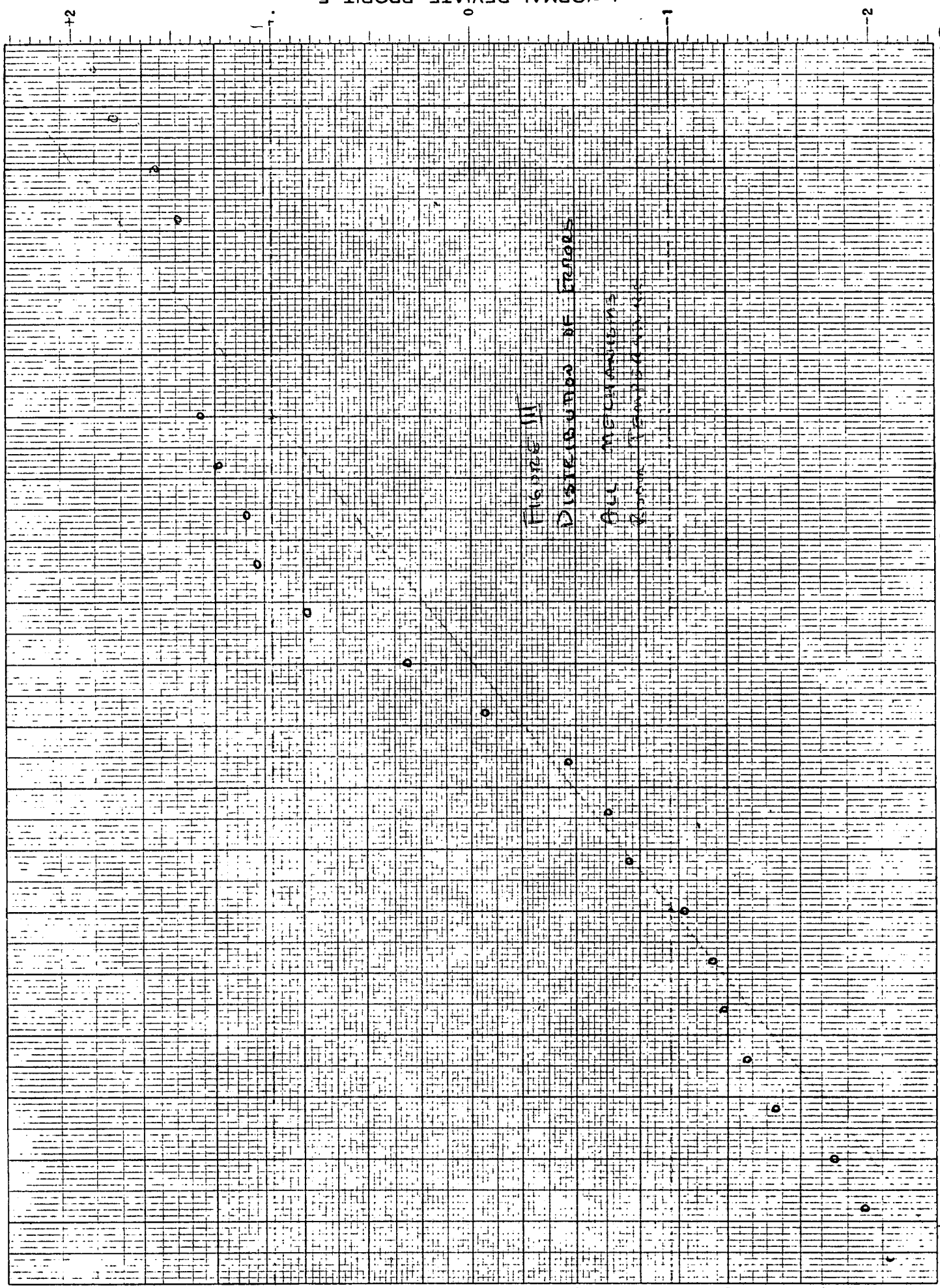
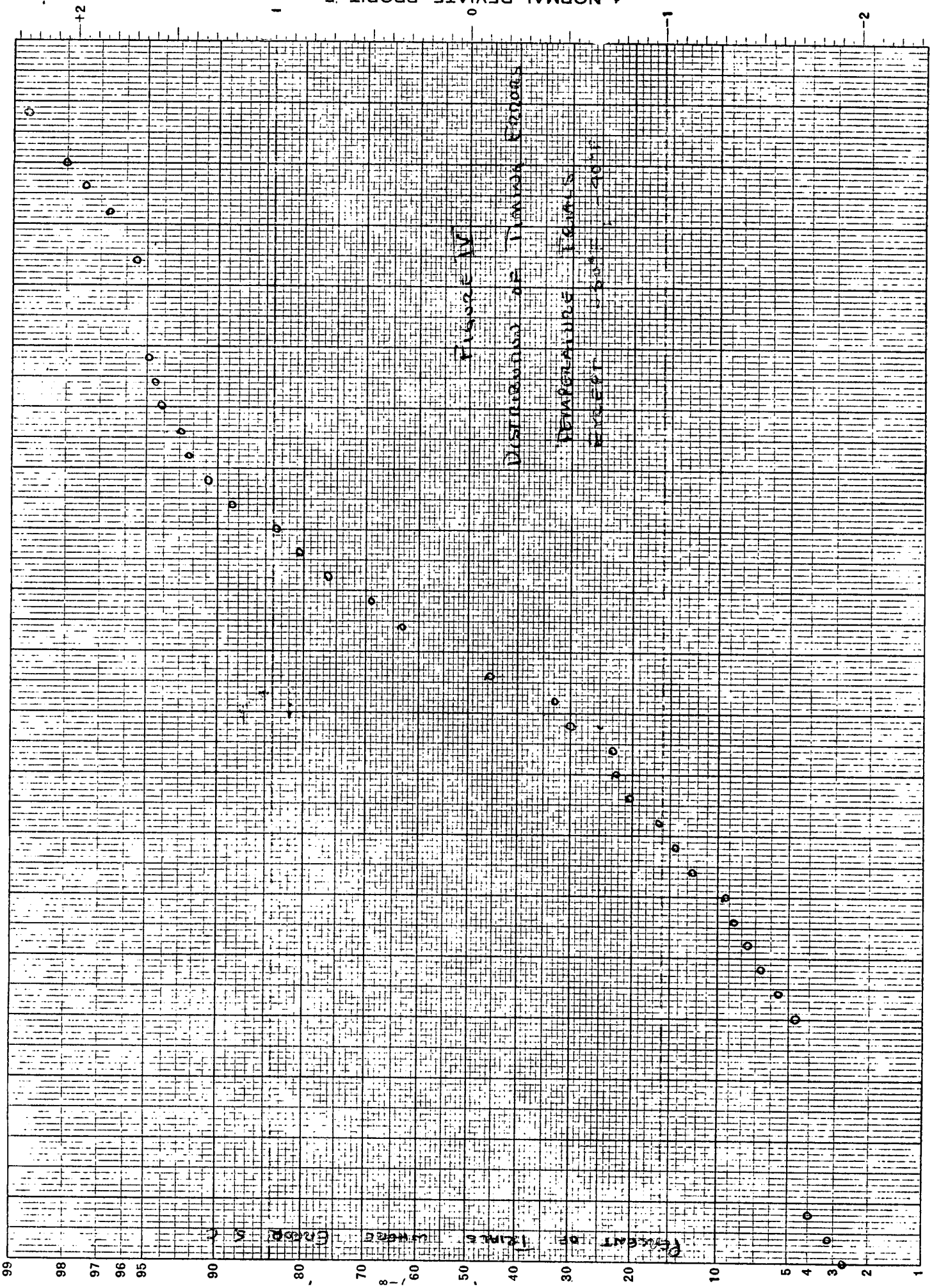


Figure III
Distribution of Errors
All Methods
Probit Analysis



MEMORANDUM

Subject: Temperature Trials

IV Operability

Although there were 20 mechanisms selected for each group, in no case would all 20 run to the completion of a test. Figure V shows the number of mechanisms for which an error was recorded on the test runs at the various temperatures. For temperatures 0° and above, the average number of mechanisms which ran to completion was 12.8 (64%). For the two lowest temperatures, only 31% of the mechanisms operated to completion.

Conclusion

There is no apparent change with temperature in the percent of mechanisms which operate to conclusion except at -30° and -40°F. when the percent of mechanisms which operates to conclusion is cut in half.

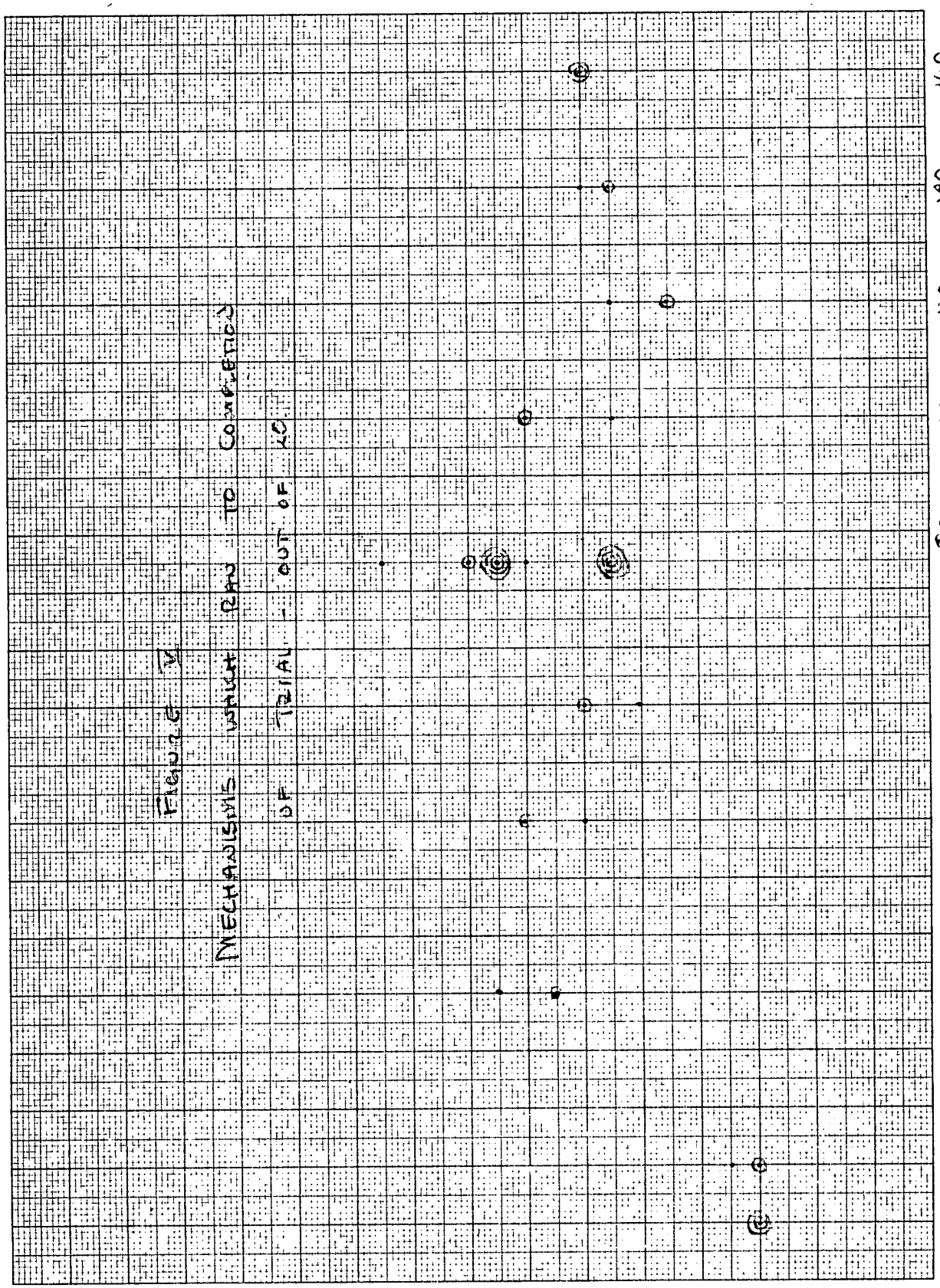
V Calibration

Of the total group of 45 mechanisms which completed one or more calibration runs, 25 had average errors $\angle \pm$ 3 minutes at room temperature. Only 28% of these mechanisms later gave readings greater than $\pm$ 5 minutes in error on test temperature runs (-30 and -40° excluded); 42% of the entire 45 mechanisms which were calibrated gave readings on test runs larger than 5 minutes in error.

Conclusion

Calibration at room temperature may provide a satisfactory basis for selecting mechanisms which will materially reduce the variation in timing errors.

From [redacted] STAT



APPENDIX
TABLE I

TIMING ERRORS, IN MINUTES

TEMPERATURE, °F.

Mechanism No.	R.T.				30			0			-30			-40		
04	-0.5	-4.5	-3.5	-3.5	-7.0	-7.0	-6.0	-5.5	-5.5	-5.0	-	-	-	-	-	-
14	+1.0	-2.0	-3.0	-4.0	-6.0	-	-7.5	-10.5	-	-	-	-	-	-	-	-
15	-22.0	-20.0	-19.0	-21.0	-9.0	-5.0	-5.0	-8.5	-8.0	-5.0	-	-	-	-	-	-
31	-18.5	-	-	-23.5	-	-	-	-	-	-	-	-	-	-	-	-
34	-4.0	-2.0	-3.0	-2.0	-1.0	-1.0	-	-1.5	-2.0	-0.5	-	-	-	-	-	-
35	-3.0	-1.0	-2.0	-3.0	-6.0	-4.0	-5.0	-5.0	-5.0	-4.5	-13.0	-13.0	-23.0	-60.0	-23.0	-13.0
41	-	-	-	+3.0	-	-	-	-	-	-	-	-	-	-	-	-
42	-8.0	-8.0	-10.0	-10.0	-	-	-9.0	-8.0	-11.0	-9.0	-	-	-	-	-	-
51	-	+2.0	-	+1.0	0.0	0.0	+1.0	-11.0	-33.0	-	-	-	-	-	-	-
54	-	-	-3.0	-1.0	-0.5	+0.5	-1.0	0.0	-1.0	-3.0	-38.0	-25.0	-41.5	-60.0	-41.5	-25.0
57	+13.0	+11.0	+7.0	+8.0	-	-	-	-	-	-	-	-	-	-	-	-
60	+1.0	+3.0	+2.0	+1.0	+1.0	-	+0.5	-0.5	-4.0	+1.0	-	-	-	-	-	-
66	+2.0	-1.0	-1.0	0.0	0.0	+1.0	0.0	0.0	0.0	0.0	-28.0	-25.0	-30.0	-34.5	-30.0	-25.0
68	+1.0	+2.0	+2.0	+7.0	+1.5	+1.5	+0.5	+0.5	+1.0	+1.5	-3.0	-3.0	-5.0	-34.5	-30.0	-3.0
75	-3.5	-0.5	-0.5	-2.5	-	-	-	-	-	-	-	-	-	-	-	-
78	-1.0	+2.0	+7.0	-3.0	0.0	+0.5	0.0	0.0	0.0	0.0	-12.0	-	-	-	-	-
89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	-3.0	-1.0	-2.0	-1.0	-2.0	0.0	-2.0	0.0	-1.0	0.0	-17.0	-14.0	-17.0	-27.0	-17.0	-14.0
92	-1.0	+1.0	0.0	+1.0	-1.0	+2.0	+0.5	+1.0	-0.5	0.0	-3.0	-9.5	-5.0	-9.0	-7.0	-9.5
100	-	+8.0	+7.0	+9.0	+17.0	+17.0	+17.0	+30.0	-	+18.0	-	-	-	-	-	-

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TEMPERATURE, °F.

Mechanism No.	R.T.				50			100		
02	0.0	-3.0	0.0	-4.0	+5.5	0.0	-1.0	-3.5	-2.0	-2.0
06	-1.0	+2.0	+1.0	+1.0	+5.5	+4.0	0.0	+2.5	-	+2.0
39	-2.5	-0.5	-1.5	-2.5	-1.0	-	-	-6.5	-	-12.5
43	-3.0	-3.0	-2.0	0.0	-	-	-	-	-	-
44	-3.5	-3.5	-2.5	-2.5	+4.5	0.0	-1.5	-3.5	-2.5	+0.5
46	-	-	-	-	-	-	-	-	-	-
47	+4.0	+4.0	+5.0	+3.0	+7.5	-	-	+11.0	-	+10.5
55	+5.5	+4.5	+4.5	+6.5	+17.5	-0.5	+15.0	-2.5	+1.5	+0.5
56	-1.5	+1.5	+0.5	+0.5	0.0	5.0	-3.5	-7.0	-6.5	-6.5
62	-0.5	+2.5	+1.5	+1.5	+3.5	-1.0	+0.5	-7.0	-1.5	-3.5
63	-	-	-	-	-	-1.0	-1.5	-	-2.0	-
70	+2.0	+3.0	+1.0	+2.0	-	-	-0.5	+2.0	-	-1.5
72	-	-	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	-	-
79	-8.5	-5.5	-7.5	-9.5	-	-	-26.5	-13.5	-15.5	-12.0
82	+2.0	-3.0	+2.0	+2.0	+1.0	+2.5	+2.0	+2.0	+3.5	+3.0
83	-0.5	-0.5	-1.5	-1.5	+2.5	-	-6.5	-2.5	-2.0	-3.0
88	+18.0	+19.0	+18.0	+24.0	+5.5	-2.5	-	-1.0	0.0	0.0
96	-3.5	-3.5	-	-0.5	+9.5	+22.0	+19.0	+21.5	+22.0	+18.0
98	-	-	-	-	-	-	-	-	-	-

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TEMPERATURE, °F.

Mechanism No.	R.T.				120			140			160		
01	-7.0	-19.0	-9.0	-4.0	-13.0	-9.0	-9.0	-8.5	-9.5	-9.0	-9.0	-3.0	-3.0
03	+21.5	+25.5	+20.5	+22.5	-1.5	+3.5	+3.5	+21.0	-6.5	-1.5	-7.5	+4.5	+1.5
07	-26.0	-23.0	-24.0	-23.0	-23.0	-	-24.0	-32.0	-15.5	-14.5	-14.5	-11.5	-13.5
08	+14.5	+17.5	+13.5	+13.5	+4.5	+9.5	+6.5	+0.5	+3.5	+5.0	+8.5	+5.0	+5.5
27	-26.0	-26.0	-26.0	-27.0	-26.0	-	-	-	-25.0	-	-25.0	-25.0	-23.0
36	+17.0	+18.0	+16.0	+15.0	-2.0	-1.0	-3.0	-4.5	-6.0	-1.5	-6.0	+3.0	+2.0
45	+4.0	+4.0	+4.0	+5.0	+3.0	+5.0	+5.0	+2.0	+2.0	+5.0	+3.0	+6.0	+6.5
50	+10.0	+9.0	+8.0	+9.0	+4.0	+2.0	-	+3.5	+2.5	+7.0	+4.0	+2.0	-1.0
52	-	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-9.0	-1.5	-2.0	-0.5	+9.5	+8.5
67	+7.0	+8.0	+7.0	+7.0	+2.5	+2.0	+2.0	+1.0	+1.0	+4.0	-1.5	+5.0	+4.0
76	+12.0	+9.0	+7.0	+3.0	+5.0	0.0	+6.0	+6.0	+7.0	+5.0	+1.0	+5.0	+3.0
85	-	-	-	-	-	-	-	-	-	-	-	-	-
86	-	-	-	-	-	-	-	-	-	-	-	-	-
87	-5.5	-4.5	-5.5	-4.5	-3.5	-0.5	-0.5	-1.5	-2.5	-1.5	-1.5	+2.5	-0.5
90	-	-	-	-	-	-	-	-	-	-	-	-	-
94	-	-	-	-	-	-	-	-	-	-	-	-	-
95	-	-	-	-	-	-	-	-	-	-	-	-	-
97	-	-	-	-	-	-	-	-	-	-	-	-	-

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MEMORANDUM

To: [redacted]
cc:

Case: 58214-AB Date: April 16, 1954 Page: STAT
QK-15-529
Subject: Request For Additional Funds

****

Reference is made to [redacted] work order request dated March 26, 1954, STAT
in which a sum of $20,000 was requested for the completion of the program. Since that time it has been requested by the client that we submit a formal proposal in lieu of the work order request. This is to be done in the immediate future. However, in order to continue the work without interruption, immediate additional funds will be required.

[redacted] was contacted and notified of the situation, and it was stated STAT
that a sum of $2,700 would be sufficient until the formal proposal is acted upon. He gave verbal authorization for the expenditure if an immediate work order request was submitted. This is to be taken as a request for those funds.

By [redacted] STAT

Approved By: [redacted] STAT

/pdw

From ..... [redacted] STAT

FORM NO. 101

 STAT

MEMORANDUM

[redacted] STAT

To: [redacted]

Case: 58214-AQ
58214-AB
QK-15-529 & 543

Date: April 2, 1954

Subject: Trip Report

Clockwork

1. On 31 March, 1954, the writer visited Messrs. [redacted] to discuss both the specifications and packaging of the AQ mechanism and the packing for the J-Feder mechanism. STAT

2. Regarding the inspection sections of AQ specifications, T219 of 15 March, 1954, [redacted] expressed satisfaction with their present form, asking only that they continue to bear the "T" designation until completion of the contemplated 1,000-unit development order. STAT

3. The proposed method of packaging the AQ unit and accessories in a collapsible tube was approved by [redacted]. The Client's packaging expert was consulted during the writer's visit, and, subject to two (2) recommendations, approved the packaging. STAT

4. The proposed method of packaging the J-Feder mechanism was approved with but one recommendation, namely that the unit be wrapped in a lint-free and lint-proof wrapper, probably aluminum foil, prior to its insertion into the can. This recommendation was made to afford all possible protection for the unit against lint from the chipboard and "pillow-pak" barrier materials.

By: [redacted] STAT

/mpk

13 Apr. Talked on phone to [redacted] told him to package ammunition in tube and to use tube with cap omit instead of a can similar to that used for canning electrolytes. STAT

[initials]

From [redacted] STAT

DOC ____ REV DATE ____ BY ____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS ____
JUST ____ NEXT REV ____ AUTH: HR 70-2

FORM NO. 101

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: March 15, 1954 Page: 1
QK-15-529

Subject: Results of Tests for Plexiglass Obscuring Material

1. At the request of [redacted], the writer has conducted a series of tests to determine which, if any, commercially available paints, enamels or adhesives would be suitable for use as an obscuring material to be applied to the plexiglass face of the AB mechanism. In theory, the application of this material over the dial face of the mechanism would prevent, or at least discourage, tampering with the unit should it be discovered in operation. STAT

2. The results of the test battery show that two (2) materials tested are suitable for such use. One, the more useful of the two materials, is a mixture of General Electric glyptal cement No. 1276, commercial lamp-black for pigmentation, and ethyl acetate for additional solvent. The second, acceptable in performance but neither as quick-drying nor hard drying as the first, is a mixture of a commercial model airplane gloss paint, "Aerogloss", and ethyl acetate for additional solvent. A summary of the results are as follows:

	Time to Tack			Time to Dry		
Material	-45°F	75°F	104°F	-45°F	75°F	104°F
Glyptal	2 hrs.	5 min.	2 min.	4-1/2h.	15 min.	3 min.
"Aerogloss"	2 hrs.	15 min.	3 min.	4-1/2h.	40 min.	6 min.

Neither material showed objectionable expansion, tending to rupture the collapsible tube container, at 150°F. for 15 hours.

3. The conditions of test were as follows:

a) -45°F., on plexiglass plates at that temperature, in both horizontal and vertical conditions, with forced air circulation.

b) 75°F., 60% RH (room conditions), horizontal and vertical, with only natural room air circulation.

c) 104°F., 50% RH, horizontal and vertical, with forced air circulation.

d) In closed, collapsible aluminum tubes, no air space, at 150°F. for approximately 15 hours.

e) All applications of the materials were made with the tubes and materials at test temperature onto plexiglass plates at the same temperature. Bare hands were used to squeeze the materials from the tube, adding a small amount of heat to the materials; it is believed, however, that this heat was negligible and had no effect on the flow or adhesion properties of the materials.

From HFK

DOC _____ REV DATE _____ BY _____
ORIG COMP 05 OPI 52 TYPE 02
ORIG CLASS M PAGES 3 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 70-2

FORM NO. 101

[redacted] STAT

4. The materials tested were as follows:

a) Super Roxite, black (paint).

b) Glyptal and lampblack with solvent.

c) Pruf Kote black (paint).

d) Nervakote adhesive #412 and lampblack with solvent.

e) Permatex No. 1 gasket compound.

f) Rutland pipe joint sealing compound.

g) Aerogloss paint with solvent.

h) Pruf Kote BX grey (paint).

i) 4R Atlas black (enamel).

j) Heresite #504 (paint).

k) Tygon TP 108 (priming paint).

l) Tygon TP 21 (paint).

Materials were requested from several paint manufacturers, with only two (2) responding by sending samples. Apparently the specification that the material was to be applied at temperatures of -40°F. to 100°F. was considered by many manufacturers to be too strict, possibly putting their product in an unwarranted, poor position for comparison. Of the two samples submitted, the Pruf Kote BX grey paint was the only paint approaching good performance.

5. Recommendations

a) The least expensive method of obscuring the plexiglass face is the use of a coarse-grit flint paper for roughing-up the surface. This method, while being inexpensive, is not the most satisfactory, since wetting of the surface with water or saliva makes the roughed portion almost transparent for short times. If any knowledge of the interior cavity and its dials is available to the opponent, it is highly probable that the "water treatment" of the plexiglass would be sufficient to allow reading of the delay setting. In short, this obscuring method is not recommended.

b) Should recommendation (a) be accepted, the obscuring material offering the best drying time and hardening time, in addition to tenacity to the plexiglass surface, is the glyptal cement-lampblack-solvent mixture. This material should be packaged in a 1/2" diameter x 2" (open size) long collapsible aluminum tube. The quantity used for filling should be somewhat less than one fluid ounce.

By: STAT

/mpk

STAT

MEMORANDUM

STAT

To:

Case: 58214-AB Date: March 15, 1954 Page: 1
QK-15-529

Subject: Revised 24-Hour Minute Hands

1. Attached is a single sample of the revised 24-hour minute hand, originally mentioned in a memorandum of January 14, 1954.

2. It is recommended that this sample be forwarded to the Client for their information.

STAT

By:

DOC ____ REV DATE ____ BY ____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS ____
JUST ____ NEXT REV ____ AUTH: HR 10-2

Attachment

/mpk

From .....

STAT

FORM NO. 101

STAT

MEMORANDUM

To: [redacted]

Case: 58214-AB
QK-15-529
Date: March 12, 1954
Page: 1

STAT

Subject: Initial Summary of Armour Research Foundation Report on Clockwork Deterioration

Reference: Armour Research Foundation Project No. C-031-2, Final Report, NOrd Contract 12347, INVESTIGATION OF DETERIORATION OF CLOCKWORK DELAY MECHANISMS DURING STORAGE

1. The following is an initial summary of items noted in the subject report.

2. The writer believes that this report deals very closely with problems which are of an immediate import to the AB investigation, and which, if future investigations of other clockwork mechanisms are conducted, will form a very basic part of any approach. As a result, a positive paper reproduction of the microfilmed report is being made for both the ADL files and the Client's use.

3. a) The report deals with mine arming clockworks, specifically those giving a delay from 0.5 to 10 days, and 3 to 145 days.

   b) Apparent faults found were as follows:

      1) Use of kraft paper as an inner wrap, without care to protect the mechanism from the inherent kraft paper dust.

      2) The high rejection rates found in the CD-8 mechanism were <u>not</u> primarily a function of lubrication difficulties.

      3) Finger marks (oxidation from perspiration) were prevalent.

      4) Poor deburring, leaving chips and other foreign materials, were present in a large degree, particularly from some specific manufacturers. Seth Thomas was <u>not</u> one of these, their manufacture showing excellent quality and care.

      5) Poor pre-assembly and pre-lubrication inspections were responsible for the assembly and shipping of large numbers of faulty mechanisms.

      6) Poor burnishing of shafts and pinions were found, resulting in uneven distribution of lubricants and the uneven wear and chipping of the high spots present in these cases.

      7) Spring lubricant was not uniformly distributed.

      8) Springs picked up foreign particles (did not say what, but presumably dust and chips) during the winding process after lubrication.

From HFK

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[redacted]

STAT

c) The CD-14 Mod 0's (3-145 days delay) were in good shape after 7 years' storage. These were Seth Thomas products. Packaging design and care seems to be the main reason for this good aging. The packaging consisted of: slip-cover tinned steel box with a silica gel dessicator included. The package was kraft wrapped and wax dipped. The outer cover was kraft paper, for handling protection only. There were some indications (after 7 yrs.) of fingerprint corrosion, but none was serious. The lubricant was OK, but showed some tendencies to oxidize (turn black, probably from oxidized metallic contaminations), and some waxes had formed. The spring lubricant was too heavy, needed a thinner, more consistent film.

d) Overlubrication appears to be a factor in the contamination problem, especially where the lube has not a good anti-creep property.

e) Summary of reasons for breakdown, as result of the study:

1) Poor inspection (a large number of units were post-war, too).
2) Faulty assembly or reworking after assembly.
3) Poor design.
4) Contamination of lubricants by lint, dust and other particles.
5) Overlubrication.
6) Lubrication deterioration and spreading.
7) Faulty packaging. (This appears to be the largest single cause, causing ruin of otherwise good mechanisms).

f) The use of chipboard barriers in metal cans still allows dust and lint contamination. See L.D. 261482 for the recommendations for steel barrier plates in cans.

g) The ratio of lube volume to lube surface area is low in watches, allowing excellent conditions for oxidation, even from the O_2 contained within the closure. (Package with RH less than 30% and use N_2).

h) As regards poor selection of materials for galvanic corrosion, the use of Bessámer screw stock is not recommended. Use stainless 303 or 416 instead.

i) Poor cleaning techniques were responsible for a large amount of contamination being introduced into the assembly.

j) The contaminations were twofold, a) mechanical variety, allowing excessive friction and binding, and b) chemical, causing corrosion and leading to mechanical binding.

k) Subassembly cleaning was the biggest offender in the poor cleaning category.

l) In the report's cleaning studies, a L & R Master cleaner was used. (using same) STAT

m) Summary of cleaning types and their recommendations:

1) Emulsion types (kero-water, carbon tet-water, etc.): Unsatisfactory in that they did not remove solid contamination and oils from recessed areas.

2) High silicate or phosphate salts, or Na or K alkalis, in water; stripped anodizing from aluminum, caustic attack on materials. Left scale deposits on brass. Did not remove perspiration contamination; was necessary to use methanol rinse to do this. Two standard hololological cleaners (probably L & R among them) did not remove types of contaminant found after long storage (5 - 7 years), nor did they remove perspiration.

3) Aqueous surfectants: seemed better than a and b. Aqueous triethanolamine oleate was the best of all tested, especially in perspiration removal.

4) Nitrogenous soaps: results good.

5) Methanol baths seem best as a practical alternative until more data are available.

n) Mixture: 3 oz. triethanolamine (practical) in 8 oz. bottle, add 1 oz. oleic acid (USP), shake until gelled. Add 4 oz. acetone and blend until homogeneous. Dilute to 1 gallon with distilled water.

o) If removal of lacquer is necessary, do it with ethyl or butyl acetate. Lacquer films harden, chip and provide additional foreign particles after storage.

p) Recommended cleaning cycle before assembly:

1) Cleaner, 10 mins. (agitation in L & R cleaner).
2) Distilled water rinse, 3 mins.
3) First naptha rinse, 5 mins.
4) Second naptha rinse, 5 mins.
5) Drying chamber, 5 - 10 mins.

Use of the distilled water rinse advised to keep cleaner drag-out to a minimum.

q) The cleaning time above is high, but will clean any contamination to the degree found in stored mechanisms.

r) Handling techniques should include baskets, rubber (sulfur free) gloves and forceps, to keep perspiration contamination low.

s) Change cleaner too frequently rather than not frequently enough.

t) FA 434 oil was evaluated. The composition is:

Di-(2-ethylhexyl) sebacate 28.3%; di (2-ethylhexyl) azelate 66.2%; phenyl-alpha-naphthyl amine 0.5%; barium petroleum sulfonate 5.0%

u) Valvoline C white spindle oil with collodial graphite (Seth Thomas Co.) is used for a spring lube.

v) 434 tended to etch steel and copper slightly during oxidation tests.

w) Nye oils became gummy during oxidation, are recommended to be removed from all Fed. specifications.

x) 434 spreads on alum. and brass in the unoxidized state; spreads on stainless, alum. and brass when oxidized.

y) Silicone oils show poor wear qualities (high coef. of friction) under load.

z) 434 tested high in anti-corrosive properties, as an inhibited oil.

aa) 434 showed slight etching in test of stainless 303 vs. clock brass; very slight in Bessemer vs. clock brass; none on drill rod vs. clock brass; slight pitting of stainless 416 vs. 75S-T6 aluminum. (Underlined materials were corroded.)

ab) 434 protected aluminum vs. steel joints perfectly.

ac) Bessemer vs. brass showed poorer results with inhibited oils than any other steel-brass combination.

ad) The naptha used for cleaning is known as Stoddard's Solvent.

By: [redacted] STAT

/mpk

STAT

MEMORANDUM

To: [redacted]

Case: 58214-AB Date: March 11, 1954 Page: 1
QK-15-529

Subject: Meeting with the Client on March 2 and 3, 1954

1. The following items reflect the AB Program decisions made during a meeting at the Reservation with [redacted] on Tuesday and Wednesday, March 2 and 3, 1954:

STAT

A. J-Feder Phase

1) In view of the fact that the movements relubricated with FA #434 oil, while showing improved low temperature performance, do not yet exhibit any improvement in their mechanical operation, it was decided that the relubrication of these movements with the #434 oil was to be discontinued.

2) In view of the fact that the original program for the J-Feder testing was intended to provide advance information for the 24-hour testing, and that this information is useful is no longer probable now that the 24-hour movement is itself in the test phase, it was decided that test sequencing, plunge tests and their interpretation were to be abandoned. The J-Feder test program now takes on the form of an investigation to find only the operational limits of the mechanism and the expected performance at these limits. The statistical handling of this performance continues valid.

3) [redacted] requested that the testing of the J-Feder movement be made with the mechanisms in face-down position, since this is the most probable position of use in the field.

STAT

2. [redacted] requested that the writer make sketches of the dial setting phase for the instruction sheet.

STAT

3. [redacted] and the writer again reviewed the 24-hour movement test program and find that the program continues to be valid without change.

STAT

4. [redacted] requested that the writer critically examine the design of the existing 24-hour case and accessories with view to the possible simplification and consequent cost cutting in production of the components. Two components to receive particular attention are the positive safety and the back cover plate.

STAT

5. [redacted] mentioned that he has received information indicating that movement main spring life is greatly enhanced by storage in the full wind condition, rather than that of half wind previously considered. He is to obtain further information regarding the storage and advise the writer.

STAT

From HFK

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[redacted]

STAT

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6. [redacted] requested the writer to recheck the energy delivered to the primer by the striker spring. It is believed that the energy delivered by the present spring is far in excess of the minimum requirements to detonate the primer; but, as a matter of record, this item shall be recalculated. STAT

7. [redacted] is to furnish the writer with copies of the original instruction sheet for the AB mechanism, to be used only as a guide for our future work in that line. STAT

STAT

By: [redacted]

/mpk

STAT

MEMORANDUM

To: [redacted] Case: 58214 Date: March 4, [redacted] Page: STAT

cc: [redacted] Subject: **March 1 Fiscal Status**

	Research (.0 and .1)				Development (.2)			
	Total Appropriation	Working Balance	Commitments	Net Balance	Total Appropriation	Working Balance	Commitments	Net Balance
501	$210,500	$16,925	$350	$16,575				
502 A	27,600	5,270	95	5,175				
503 B	8,000	1	-	1	$23,363	$1,470	$1,430	$40
504 C	10,609	2	-	2	40,050	15	-	15
505 D					48,000	13,550	50	13,500
506 E					66,482	11,785	9,800	1,985
508 G	8,587	1,685	860	825	17,500	140	-	140
509 H					37,618	4,090	-	4,090
510 I	10,760	4,455	4,045	410				
511 J	12,300	1,245	-	1,245				
514 M	16,000	25	-	25	8,000	1,655	20	1,635
515 N	19,340	100	-	100	28,350	660	-	660
516 O	13,500	80	-	80				
517 P	19,815	10	-	10				
518 Q	5,900	40	-	40	47,220	505	-	505
519 R	33,000	2,105	1,980	125				
522 U					44,200	2	-	2
522 U (S)					164,827	5,205	-	5,205
523 V	18,850	700	10	690				
525 X					123,354	4,880	-	4,880
527 Z	8,200	2,815	-	2,815				
528 AA	8,776	10	-	10	51,375	7,700	10,000	(2,300)*
529 AB					77,443	39,500	36,270	3,230
531 AD	500	25	-	25	39,718	5,360	-	5,360
535 AH	29,821	2,480	280	2,200				
537 AJ	44,540	18,855	15,310	3,540				
538 AK	7,000	370	50	320	3,500	1,450	-	1,450
541 AO	500	-	-	-	11,605	1,275	-	1,275
543 AQ	7,400	300	875	(575)*				
544 AR	6,400	1,290	-	1,290				
545 AS	16,000	2,845	5,910	(3,065)*				
546 AT	1,500	640	-	640				
547 AU	500	450	-	450				
550 AX	20,000	2,870	280	2,590				
551 AY	1,500	1,500	-	1,500				
552 AZ	10,700	10,540	-	10,540				
553 BA	500	50	50	-				
554 BB					11,300	4,230	4,060	170

* AA - Funds requested Feb. 23, 1954
AQ - Funds requested Feb. 23, 1954
AS - Funds requested Feb. 5, 1954

From: [redacted] STAT

For: Arthur D. Little, Inc.

STAT

MEMORANDUM

To: [redacted]

STAT

Case: 58214-AB Date: February 1, 1954 Page: 1
QK-15-529

Subject: AB Adapters

1. On January 27, 1954, Thomaston Special Tool Company forwarded to the writer six adapters intended for trial prior to the production of the full order.

2. These adapters were tested as follows:

   a) All adapter threads were fitted into various mating parts and were found to be satisfactory as regards both size and pitch with the one following exception: the 1/2" - 26 BSF 55° Whitworth Thread was found to be too long by approximately 1/64" to allow full mating and gasket compression with the M-34 detonator.

   b) One adapter was assembled with an AB case and a live M-34 detonator and field tested by firing. Good

3. Thomaston Special Tool Company has been instructed to shorten the mating M-34 thread by 1/64" and to produce the remaining number of adapters, plus one to replace the destroyed unit as quickly as possible.

4. On January 28, Mr. Frank DeBisschop, of Thomaston Special Tool Company, advised the writer that there will be some one or two weeks additional delay in the production of these adapters as a result of slow delivery of the thread test gauges of this unit.

By: [redacted]

STAT

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/mpk

From HFK

[redacted]

STAT

FORM NO. 101

STAT

MEMORANDUM

STAT

To: [redacted] Case: 58214-AB Date: February 1, 1954 Page: 1
QK-15-529

Subject: Telephone Conversation with [redacted]

STAT

1. In a telephone conversation with [redacted] on January 25, 1954, the following points were decided.

STAT

OK HFK

   a) The revised cocking plug incorporating a lock screw as previously reported in a memorandum of January 14, 1954, was approved for production.

   b) The refinishing of hour drums and minute hands, to produce a non-reflective surface on the drum and a better indication by the hour hand, was also approved.

2. Both Thomaston Special Tool Company and the New Haven Clock & Watch Company have been instructed to commence production of these items.

3. The writer requested that [redacted] supply at the earliest possible date additional quantities of the Frankford Arsenal #434 Oil for relubrication of the AB movements.

STAT

OK HFK

STAT

By: [redacted]

/mpk

DOC ____ REV DATE ____ BY ____
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From HFK [redacted]

STAT

FORM NO. 101

STAT

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: February 2, 1954 Page: 1
QK-15-529

Subject: Telephone Conversation with [redacted] STAT

1. In a telephone conversation with [redacted] this date, the following points were decided: STAT

   a) On the basis of the low temperature performance attained in the J-Feder movement by the use of FA #434 Oil, and the indications obtained from the low temperature spring tests, it was decided to eliminate Myvolube "A" from the lubricant test battery. FA #434 Oil is to be substituted in its place. This represents a major change in the AB Mechanism Test Program. New Haven Clock & Watch Company has been instructed to submit an estimate of the changes involved for the relubrication of the remaining 900 movements now in their plant.

   b) [redacted] authorized the immediate initiation of the J-Feder Packaging Program along the lines outlined verbally by the writer, using a special can for this purpose. STAT

By: [redacted] STAT

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ORIG COMP 05b OPI 52 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS _____
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/mpk

From HFK

[redacted] STAT

FORM NO. 101

MEMORANDUM

To: [redacted]

Case: 58214-AB Date: January 14, 1954 Page: 1 STAT
QK-15-529

Subject: Revised Cocking Device for AB Case

1. During his recent visit to the reservation, [redacted] of STAT Thomaston Special Tool Company, mentioned the possibility of redesigning the present cocking device to allow greater freedom of the operator's hands during the cocking operation. Using the present design device, it is necessary that the operator exert constant pressure to maintain the firing spring compressed during the setting of the firing linkage. With this revised cocking device the operator would be able to lock the firing spring in position prior to setting the linkage, allowing him greater freedom and concentration of his attention to the proper setting. Good.

2. The writer believes Thomaston's idea to be basically sound and with one change in their design, should be seriously considered for production with the present AB mechanism. This change recommended is the substitution of the screw by a drive-pin or an oversize screw in place of the present one, both primarily intended to prevent movement of this locking screw during operation. O.K!

By: [redacted] STAT

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/mpk

From HFK

[redacted] STAT

FORM NO. 101

MEMORANDUM

[redacted] STAT

Case: 58214-AB Date: January 14, 1954 Page: 1
QK-15-529
Subject: AB Movement Hands and Hour Drum

1. New Haven Clock & Watch Company has submitted for our approval hour drums which have been sprayed with a nonreflective black enamel. This change in surfacing is intended to eliminate the glossy black surface which has been produced for the 1,000 movements now on hand. New Haven is to follow up with an estimate showing the relative costs of stripping the existing drums for 1,000 movements versus the cost of producing 1,000 new drums.

2. New Haven has also submitted sample hands, longer and thinner than the original hands, which are intended to make close setting of delay times do they? easier. These hands are to be finished with a black oxide coat and a luminous line for night use. New Haven has been instructed to procure and finish at least 1,000 of these hands without further delay.

How do they look

By: [redacted] STAT

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/mpk

From HFK

[redacted] STAT

FORM NO. 101

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: January 13, 1954 Page: 1
QK-15-529
Subject: AB Case Gaskets

which gaskets?

1. Both [redacted] STAT of Thomaston Special Tool Company, and the writer believe that the present "Coroprene" gasketing material used on the AB case is entirely too soft for its intended purpose. In addition to this, a "paper" investigation of the physical and chemical properties of neoprene, Buna-N, and thiokol shows that the neoprene is slightly inferior to either of the others for the intended service, particularly as regards resistance to solvents and light petroleum products.

2. As a result of these difficulties, the writer has requested Thomaston Special Tool Company to procure a very limited quantity of AB case gaskets in both thiokol and Buna-N materials for comparative tests. The proposed specifications for these materials are as follows:

thickness:	.025 - .030"
hardness:	65 - 75 durometer
color:	black or gray

The above thickness represents a change over the present practice by reducing the present thickness to one half. By this method it is hoped that the closure pressure can be increased without producing adverse bulging or distortion of the gaskets.

By: [redacted] STAT

what about stuffing box seals??

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/mpk

From HFK [redacted] STAT

FORM NO. 101

STAT

MEMORANDUM

[redacted]

To: [redacted]

STAT

Case: 58214-AB Date: December 31, 1953 Page: 1
QK-15-529

Subject: Mainspring Tests for AB Mechanism

1. A series of tests have been completed in which the New Haven flat and the Sandvik 24-mm curved section springs were compared for use in the 24-hour AB mechanism under normal and low temperature conditions.

2. The conclusions reached are as follows:

   a) At normal temperatures (75°F) the Sandvik spring delivers 10% more useful power than the comparable flat spring, but for the anticipated 24-hour mechanism this increased power is not of great significance.

   b) At low temperatures both springs deliver adequate power to drive the 24-hour mechanism either in a dry (unlubricated) state or with a dry lubricant.

   c) At low temperatures, using a liquid lubricant in the mechanism, the governing consideration becomes that of efficient usage of the available power; any individual differences that might exist between spring types are completely obscured by the manyfold increase in lubricant viscous friction.

3. In the proper evaluation of the above conclusions it is well to keep in mind that the present 24-hour design is conservative in its demands on the movement power output. In any future design that may attempt longer continuous operating periods, the power output available probably will be more severely taxed, i.e., the design will be less conservative than that of the present unit. On this basis the conclusions reached for the 24-hour movement are not necessarily correct when applied to the problem of a less conservative design in which the question of power supply would be more critical.

4. Also for proper evaluation of the above conclusions, the writer would point out that the proper selection of the mechanism lubricant for low temperature operation cannot be overemphasized. Any mechanism in which the power supply is less conservatively designed than the present will require careful lubricant selection if the full capabilities of the mechanism are to be realized.

5. Details of Tests

   a) Description of Sample

      (1) Watch type: New Haven Clock & Watch Co. "dollar" movement, stem winding, without dial, hands or case; no special selection of sample movements was used.

      (2) Spring types: 9 samples of Sandvik 24-mm curved section spring.

From HFK

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10 samples of New Haven Clock & Watch Co. flat spring (standard with the "dollar" type watch).

(3) Lubrication: These movements originally lubricated with Myvolube "A" at the factory. Tests later run with "Molykote" powdered molybdenum disulfide and Frankford Arsenal oil #434.

b) Description of Tests

(1) Free-running time at room temperature (70-75°F) to determine the duration of power delivery from each type spring with Myvolube "A" as lubricant.

(2) 24-hour endurance test at progressively lower temperatures to determine point at which movements would not run the required 24 hours with Myvolube "A" as a lubricant.

(3) 24-hour endurance test of small sample lots at approximately -75°F to determine length of running time with no lubricant (movement washed clean) and with molybdenum disulfide as a lubricant.

(4) 24-hour endurance test at approximately -45°F and -75°F, as above, with Frankford Arsenal oil #434 as a lubricant.

c) Results of Tests

(1) Free Running Time*

		Free Running Time @ 70-75°F, Hrs.		
Spring	No. Samples	Minimum	Average	Maximum
24-mm	9	25.5	36.4 33.1	37.5
NH Flat	10	31.5	33.1	33.5

* All movements started with fully wound springs.

(2) Endurance at Progressively Lower Temperatures

Stoppage of 50% of the sample at any given time before the 24-hour limit was considered to be the point at which the entire sample was rejected. Under these conditions both springs were considered satisfactory from -10°F down to -30°F. Between -30°F and -40°F all samples failed to operate, indicating that the limiting factor in this case was that of lubricant failure. (Note: This is confirmed by the Client's information which indicates Myvolube "A" is unsatisfactory below -35°F.)

DRY

(3) Endurance of Low Temperatures, -45 to -75°F *

Four (4) movements, cleaned of all traces of lubricant, ran successfully for more than 28 hours in both the -45°F and -75°F tests. Beat timing records indicated that the movements tended to become rough in their action during the early hours of the tests, but later became smooth.

Two (2) movements lubricated with "Molykote" (introduced in a carbon tetrachloride mixture onto a movement which had been previously heated to 225°F) ran successfully for more than 28 hours at both -45°F and -75°F. Beat time records indicated that these movements were smooth in their action at all times during the test.

(4) Low Temperature Test with FA #434 Oil*

Two (2) movements lubricated with FA #434 oil were tested and found quite satisfactory at -45°F but tended to become slightly erratic at -75°F. This is believed to be the result of poor spring lubrication technique rather than poor lubrication performance. In all cases, however, both springs delivered adequate power to drive the movement over 26 hours.

when will you know.

6. General Notes

The entire test program was one in which the springs were subjected to very quick temperature changes, sometimes in the order of 150°F plunges. In no case was there breakage that could be contributed to thermal shock.

By: [redacted] STAT

/mpk

* Sample springs evenly divided between Sandvik and New Haven types.

STAT

MEMORANDUM

To: [redacted]

STAT

Case: 58214-AB Date: December 30, 1953 Page: 1
QK-15-529

Subject: **Information on Molybdenum Disulfide as a Lubricant**

1. **The following information is summarized from available manufacturers' literature on molybdenum disulfide lubricants:**

A. **Manufacturers & Products**

1) **Climax Molybdenum Co., 500 Fifth Avenue, New York 18, N. Y. "Moly-sulfide" in powder, grease, oil and solvent vehicles, suspensions and dispersions.**

2) **The Alpha Corp., Greenwich, Connecticut. "Molykote," in powder, grease, oil and solvent vehicles, suspensions and dispersions.**

B. **Properties**

1) **Physical**

a) **Specific gravity:** 5. (approx.)
b) **Hardness:** 1-1.5 Mohs scale
c) **Molecular thickness:** 6.26°A

2) **Thermal**

a) **Useful range -90°F to 750°F.**
b) **Slow oxidation in air from 750°F to 1100°F.**
c) **Rapid oxidation in air from 1100°F and up.**
d) **Stable in inert atmospheres to 2400°F.**
e) **Will oxidize at room temperature in pure oxygen.**

3) **Electrical**

a) **Essentially non-conductive in unpressed form.**
b) **Poor conductivity with low voltages.**
c) **Fair conductivity with high (150V and up) voltages.**
d) **Non-magnetic in all forms.**

4) **Chemical**

a) **Resists attack by all materials except**

(1) **Aqua regia**
(2) **Boiling HCL, hot F_2 and CL_2**
(3) **O_2 at room temperature**

b) **Non corrosive within known working temperatures and conditions, except as noted above.**

From HFK

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c) Will not inhibit corrosion effectively unless extremely well applied to surface by mechanical means.

d) Shows bonding affinity for steel, brass, etc., at room temperatures; bonding increased by mechanical application.

5) Present Uses

a) In bearing loads up to 400,000 psi (note: this is far in excess of physical limitations of current materials.)

By: [redacted] STAT

/mpk

STAT

MEMORANDUM

STAT

To:

Case: 58214-AB Date: December 14, 1953 Page: 1
QK-15-529

Subject: Trip Report to Thomaston Special Tool Co. and New Haven Clock & Watch Co.

1. On December 8, 1953, and the writer visited the Thomaston Special Tool Company, Thomaston, Connecticut, for a general review of the current AB production. In general the entire program seemed well in hand and expressed his general satisfaction.

STAT STAT

2. Special items discussed during this visit were as follows:

   a) The question was raised as to the effectiveness of the present gasketing on the case; the original plans of the 24-hour movement show no gasketing on either the positive starter or safety glands in the case. It was decided that ADL would conduct extensive tests of the vapor tightness of the case to determine whether or not the permeability over a 24-hour period was excessive.

   b) In conjunction with the gasketing problems above, ADL was also to run comparative tests of the performance in light solvents of both thiokol and coroprene gasketing materials.

   c) ADL was to redesign the sear lever to allow additional clearance to uncover the numerals on the watch dial; this action would apply to future production only.

   d) ADL was to send six personnel security questionnaire forms to in preparation for the clearing of additional personnel at Thomaston Special Tool Company.

STAT

   e) Thomaston is to paint the inside of the dial cavity in the case with the same color paint as now used on the outside.

   f) Thomaston is to trim the back plate gasket to eliminate the gasket overhang which now prevents the full seating of the safety retainer.

   g) Thomaston is to bring up to date as quickly as possible all drawings of the case, linkages and accessories.

   h) Thomaston is to cut down one back plate cap to investigate the clearance available between the cap and the movement winding stem.

3. As the result of several minor assembly difficulties encountered during the past week, the original delivery date of December 18th for 100 assemblies is being pushed back to approximately December 21st.

4. During the visit one complete assembly was made up from parts available and a satisfactory operating unit was obtained. took this assembly with him to his office for further examination and evaluation.

STAT

From HFK

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5. On Wednesday, December 9th, [redacted] STAT and the writer visited the New Haven Clock & Watch Company to discuss the present status of the movement development. The following items reflect the topics discussed during that meeting:

   a) New Haven to obtain samples of and submit quotations for a new minute hand, similar in shape but longer than the one now in use.

   b) New Haven to black oxidize the new hand and the retaining nut on all future deliveries.

   c) New Haven is to investigate the possibility of reblackening the existing hour drums to provide a nonreflective surface and make plans to provide such a finish on all future deliveries.

   d) New Haven is to black oxidize the winding stem and chain on all movements now on order and in all future deliveries.

   e) New Haven is to assemble 50 movements with the 24mm Sandvik Springs for future delivery.

6. The New Haven Clock & Watch Company has now assembled and on hand the 900 movements remaining on our order. They have been instructed to withhold delivery of these movements to Thomaston Special Tool Company until such time, estimated to be on or about February 1st, as ADL has completed their test agenda.

7. [redacted] STAT expressed extreme interest in the test program to which we are subjecting the movements, and expressed his hope that any information that could be cleared to him regarding the low temperature performance of various lubricants in the movement would be made available for their engineering files.

8. In general the entire tenor of the visit was one of apparently increased cooperativeness, due in part to the fact that we are doing work which they will find of some value to themselves. In view of this fact the writer has tentatively promised to forward as soon as possible all unclassified information which they requested.

By: [redacted] STAT

HFK/mpk

MEMORANDUM

To: [redacted]

Case: 58214-AB Date: December 4, 1953 Page: 1 STAT
QK-15-529

Subject: Outline for 24-Hour AB Tests

Enclosure: (1) Clock Test Program - R. G. Brown Report of November 13, 1953

1. The following is the proposed outline for the 24-hour AB Test Program. The enclosed report by [redacted] treats in detail the statistical aspects of sampling and program scheduling. STAT

2. In general, the entire program is to be treated in four (4) phases, as follows:

   a) Lot tests to determine individual differences between movements.

   b) Family tests to determine the low-temperature elimination point of alternate movement lubricants.

   c) Family tests to determine effects of various temperature conditions on movement operation characteristics.

   d) Lot tests to determine overall effect of various maximum short-term storage and useage conditions.

3. Detailed Outline of Test Program:

   I. Initial Check

      A. All assemblies shall be tested as follows in their "as received" condition:

         1. All assemblies shall be visually inspected for proper assembly and action.

         2. All movements shall be fully wound and allowed to operate for 24 hours to completion of the firing cycle.

         3. All movements shall be fully wound, allowed to run approximately 12 hours, and then their beat timing shall be checked against the "Watchmaster" timing standard.

         4. All movements shall then be checked and set. for reproducibility of operation over three (3) complete 24-hour cycles, each cycle being checked by both beat time and dial readings at three (3) points during operation.

         5. As the result of data obtained, the movements shall be assigned test sequence numbers, depending on the indications obtained, as outlined in R. G. Brown's report, Page 1, of November 13, 1953, enclosed.

DOC ____ REV DATE ____
ORIG COMP 056 OPI 56 BY ____
ORIG CLASS M PAGES 4 TYPE 30
JUST ____ NEXT REV ____ REV CLASS ____
AUTH: HR 10-2

From HFK

[redacted] STAT

FORM NO. 101

II. Lubrication Tests

A. The present low-temperature test point for watch lubricants has been defined by the Armed Forces as -65°F, and tests shall be made to determine whether or not one or more of the following lubrication conditions will allow satisfactory operation of the 24-hour movement and linkages at temperatures approaching this point.

B. The lubrication conditions currently under consideration are:

1. Dry
2. Myvalube (as received from N.H.C. & W. Co.)
3. Molybdenum disulfide
4. Frankford Arsenal #434

C. 24 movements shall be selected and lubricated as outlined in R. G. Brown's report, Page 1, and subjected to progressively lower operating temperatures until two (2) lubrication conditions are eliminated by reason of failure (stoppage) of 50% of the respective sample movements. The two (2) conditions remaining shall then be subjected to further reduced temperatures to determine their limitations. This shall be repeated for three (3) 24-hour operation cycles to determine reproducibility at their respective minimum operating temperatures.

III. Temperature Tests

A. The performance rating of the assemblies at various temperatures shall be based on two (2) criteria

1. Movement performance, as determined by maximum changes in beat time throughout the 24-hour cycle.

2. Assembly performance, as determined by the successful firing of the primer at the end of each cycle.

B. The interpretation of the term "performance rating" and the setting of limits of satisfactory performance shall be determined by statistical treatment of test data at the end of all tests in this battery.

C. Using the two (2) lubrication conditions found to survive the previous low-temperature elimination tests, the temperature test battery shall proceed as follows:

1. A random sample shall be selected for each of the two (2) lubrication conditions to be tested.

2. Depending on indications obtained from the J-Feder tests as to the presence or absence of cumulative tendencies toward failure resulting from test sequence, the temperature tests shall be scheduled as follows:

a) Either in combinations, to detect all possible differences in sequence of test conditions, or

b) In succession, with no attempt to detect cumulative sequencing effects.

c) Each temperature test shall be run three (3) times to determine reproducibility of results, as outlined in [redacted] STAT report, Page 3.

IV. Useage and Storage Conditions

A. Under this section, it is intended to duplicate in test the maximum probable conditions under which various useages and storages can be anticipated. This battery of tests will reflect the overall capability of the assembly to withstand these anticipated conditions and yet allow setting and operation to a successful completion of the 24-hour cycle.

B. Tentative "Maximum Useage" conditions include the following:

1) Submerged operation for 24 hours at 77°F in

a) Water, 20 foot equivalent depths

b) Gasoline, 10 foot equivalent depths

c) Diesel oil, 10 foot equivalent depths

2) Completely encased in an ice film, produced by exposure to water fog at 25°F to 30°F ambient temperature

3) Other conditions of particular interest to the client.

C. Tentative "Maximum Storage" conditions include the following:

1) Storage at -20°F for 2 weeks

2) Storage at 160°F - 90% RH for 2 weeks

3) Storage at room temperature (77°F) under salt water (sea water) for 2 weeks

All units tested shall be examined for ease of setting and satisfactory performance at storage conditions.

V. Standard Engineering Tests

A. Standard engineering tests shall be altered to suit the client's

wishes and the nature of the unit. An outline of these tests shall be submitted at a later date.

By: [redacted] STAT

/mpk

MEMORANDUM

To [redacted] STAT

Case: 58214 Date: November 13, 1953 Page: 1

Subject: Clock Test Program

This memorandum incorporates some of my preliminary ideas on the design of the test schedule for the American made clocks.

Initial Check

The first step will be to check all the clocks as they arrive from the factory at room temperature. These tests will include both reproducibility and timing accuracy.

If the first timing and reproducibility tests show no essential variation by the clocks, put them in order by factory serial number; if the first test shows that there is an essential difference between clocks, put them in order from best to worse by some characteristic such as accuracy, rate, or reproducibility. In either case, number the clocks from 1 to 100. These numbers are used in what follows as the basis for selected clocks for each phase of the test.

Oil Elimination

One of the objectives of this test program is to decide on the proper lubricant to use in the clocks; and, as I understand it, there is a good likelihood that at least one of the alternatives will be eliminated in the cold test. Therefore, I think that it is appropriate that the next step in the test program be to eliminate one of the lubricants. To do this select 24 clocks with numbers given in Table I. The first column headed "Dry" gives the numbers of the six clocks which are t to be run with no oil. The second column headed "As Is" gives the numbers of the six clocks to be run with the oil used at the factory. The third and fourth columns give the test numbers of the clocks to be tested with two alternate types of oil. These 24 clocks will be run through a cold test at sufficiently low temperature to eliminate one of the lubricants from further consideration.

TABLE I

Lube Elimination Test (24 clocks)

Dry	As Is	Alt. #1	Alt. #2
5	9	13	17
21	25	29	33
37	41	45	49
53	57	61	65
69	73	77	81
85	89	93	99

From [redacted]

STAT

FORM NO.

MEMORANDUM

Lubricate Clocks

Now we have reduced the possibilities to three lubricant conditions - A. Dry, B. As Is, C. - the successful one of the alternative lubricants. There are six clocks which have been prepared with each of these lubricating conditions. Seventy-two more clocks should be oiled as given in Table II, so that there is a total of 30 clocks in each of three lubricant conditions.

TABLE II

Lubrication Schedule
(90 Clocks)

	Dry - A					As Is - B					Successful Alt. - C				
Group	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1 either or and:		C2	C3	C4	C5
	5	6	10	14	18	9	11	7	15	19	13	17	8	12	16	20
	21	22	26	30	34	25	27	23	31	35	29	33	24	28	32	36
	37	38	42	46	50	41	43	39	47	51	45	49	40	44	48	52
	53	54	58	62	66	57	59	55	63	67	61	65	56	60	64	68
	69	70	74	78	82	73	75	71	79	93	77	81	72	92	80	84
	85	86	90	94	100	89	91	87	95	1	93	99	88	76	96	2

Temperature Tests

If the J-Feder tests show that there is a noticeable interaction between various sequences of temperature conditions, we should select groups of clocks to be put through five different temperature cycles which provide for every possible combination of temperatures in pairs. These sequences are given in Table III.

From.....

MEMORANDUM

To: Case: Date: Page: 3

Subject:

TABLE III

Sequences of Temperature Tests

(Subject to Modification by J-Feder Test Experience)

A = 77°
B = -20°
C = +120°
D = Cycle
E = -60°
F = 160°

Groups (Table II)	Sequence
A1, B1, C1	A B C D E F
A2, B2, C2	B D A E F C
A3, B3, C3	C A D F B E
A4, B4, C4	E F B A C D
A5, B5, C5	F C E B D A

Note that there are 18 clocks in each group, six with each of the three lubricant conditions. I believe that it is possible to handle at least 18 clocks in one temperature box at a time.

Storage Test

If, on the other hand, it is decided that an acceptable procedure would be to select a group of clocks and put it through each of the temperature tests in succession, it is possible to use the remaining clocks for the storage test to determine the effects of storage conditions on the lubricant conditions. The sequence to be used would be the first line of Table III, since the highest temperature - which may cause damage - is last. In this case, we would test immediately the 18 clocks in group A1, B1, and C1 from Table II. Table IV shows the numbers of the clocks to be stored under three possible storage conditions, One of these conditions would probably be high temperature and high humidity, a second storage condition may be at room temperature or at possibly very low temperature, and a third possible storage condition might be in a cycling temperature, or salt spray, or prolonged vibration, or other condition of interest.

From.....

STAT

FORM NO. 101

MEMORANDUM

To: Case: Date: Page: 4

Subject:

TABLE IV

Storage (72 Clocks)

STORAGE	I			II			III		
LUBRICANT	A	B	C	A	B	C	A	B	C
HALF MAX.	6	11	13*(17)	42	39	44	78	79	76
	22	27	29*(33)	58	55	60	94	95	96
STORAGE	38	43	45*(49)	74	71	92	18	19	20
	54	59	61*(65)	90	87	16	34	35	36
MAX.STORAGE	70	75	77*(81)	14	15	32	50	51	52
	86	91	93*(99)	30	31	48	66	67	68
	10	7	12	46	47	64	82	93	84
	26	23	28	62	63	80	100	1	2

These clocks would be stored for some period of time. The first four clocks in each column of Table IV (Total 24 clocks) would be tested after perhaps half the maximum storage period. The second four clocks in each column of Table IV would be tested at the end of the maximum storage period. The test temperature sequence would be ABCDEF (Table III).

Clocks for Other Tests

This test program has used up 96 clocks: the six that were originally oiled with the unsuccessful lubricant and thirty oiled with the three competing lubricants. The other four clocks in the sample will probably be used in vibration tests, shock tests, and other tests provided in the test agenda. It is possible to be more economical of clocks on the temperature testing program if it is possible to use the same clocks over again. For example, in the storage test it might be adequate to test a series of clocks at the end of half the storage period, put these back into storage and test them at the end of the storage period. However, running the clocks in this way may have some type of effect on the aging of the lubricants.

Hence, I would suggest that if additional clocks are needed for other parts of the test program, they be taken from the clocks that have already been put through this test program. Thus, there would be 18 clocks available after the initial test, 36 more after the complete storage life test.

From.....

STAT

FORM NO. 101

MEMORANDUM

To: Case: Date: Page: 5

Subject:

Summary

This test program takes into account: a) the effects of the different lubricants both when they are new and after storage under various conditions, and b) the various operating characteristics of the clocks under critical conditions of temperature and humidity. If the storage test is used, it would be necessary to have available one box at a time for each part of the temperature test and three storage boxes large enough to hold 24 clocks. If, on the other hand, it is decided to try the various sequences of temperature conditions on the clocks when they are new, it would be necessary to have available concurrently one box for each of the six temperature conditions, these boxes being large enough to hold 18 clocks at a time.

From [redacted] STAT

FORM NO. 101 RGB:jhl [redacted] STAT

To: [redacted]

Case: 5824 Date: July 30, 1[illegible] Page: 1

Subject: J-Feder Test Program

[redacted] memorandum of July 28 describes a series of four tests STAT to be given to determine the performance of clock mechanisms at -20°F and at +120°F. The series is preceded and followed by timing tests at 77°F.

The present memorandum recommends a schedule and sampling procedure which will yield the maximum of desired information with the minimum test.

Sample

For the principal tests, it will be necessary to select 12 clocks, each of which will enter into only a part of the tests. These clocks should, if possible, be selected by serial number (00 to 90) as in the following table, and assigned the corresponding sample number which will be used for reference.

Serial Number	Sample Number	Serial Number	Sample Number
51	1	10	7
73	2	70	8
49	3	37	9
44	4	64	10
87	5	39	11
42	6	47	12

Tests

The tests to be run are designated by letters as follows:

A. 21-day timing test of all 12 clocks at 77°F
B. 4-day operation test at -20°F
C. 4-day operation test at +120°F
D. 2-day operation test with cycling temperatures.

Schedule

The schedule of tests given in the following table uses a total of 10 clocks for each of the tests B, C, and D, with a maximum of 5 being given any one test at a time. The tests are each given twice, except test B, which is repeated for a total of three times. Tests C and D can--if the equipment is available--be run concurrently in each cycle.

From [redacted] STAT

DOC ____ REV DATE ____ BY ____
ORIG COMP 05[illegible] OFF 5[illegible] TYPE 02
ORIG CLASS 4 PAGES 2 REV CLASS ____
JUST ____ NEXT REV ____ AUTH: HR 10-2

Next 1 Page(s) In Document Denied

Timing device, Clockwork

MEMORANDUM

To: [redacted] STAT
cc: [redacted]

Case: 58214-AB Date: December 3, 1953 Page: 1
QK-15-529
Subject: Meeting With [redacted] STAT

****

On Tuesday, December 1, a meeting was held with [redacted] to STAT discuss the progress of the J-Feder and AB unit. Messrs. [redacted] STAT represented [redacted] STAT To avoid confusion the meeting was broken down into two parts, the first to discuss the J-Feder and the second the AB device. Outlined below are the decisions reached at that time.

J-Feder. 1) The adapter for the J-Feder is to be designed so as to fit a coupling base identical with that employed in the L unit. One adapter and two coupling bases are to be included in the package.

2) The adapter is to be constructed of aluminum.

3) [redacted] STAT is to submit samples of the coupling in the immediate future. These are to be followed up by 2,000 units.

4) A coupling is to be assembled with the adapter in the package.

5) The wrench for the old primer is not to be included in the package.

6) [redacted] STAT is to investigate the feasibility of employing a can for the package. Standard commercial cans are to be employed.

7) [redacted] STAT is to send to the Reservation at the earliest possible time the portable canning machine.

8) No provision is to be made to introduce an inert atmosphere in the can.

9) The cans are to be painted in a manner exactly similar to the AB device.

10) The cans are to be labeled "Clockwork, Twenty-One Day."

11) The calibration booklet is not to be included in the pack.

12) A rough draft of the instruction sheet was exhibited to Mr. DanBrunt. It was stated that with a few minor changes it would be acceptable. This is to be formalized and submitted to the client immediately.

13) It was agreed that the statistical study of the test results for the J-Feder is to indicate reliability.

DOC	REV DATE	BY	
ORIG COMP 056	OPI 56	TYPE 02	
ORIG CLASS M	PAGES 2	REV CLASS	
JUST	NEXT REV	AUTH: HR 10-2	

From JPS

FORM NO. 101

[redacted] STAT

AB Device. 1) The test program with a cover memorandum is to be submitted immediately.

2) [redacted] is to obtain specifications for the STAT myvolube oil.

3) The high temperature tests for the device are contingent on the results obtained with the J-Feder.

4) [redacted] is to investigate the use of Thiokol STAT "O" rings to replace the gaskets on the face and the back of the device. This is to prevent any hydrocarbon leakage if the device is to be used in such a manner.

5) [redacted] is to investigate a paint covering STAT for the face of the luminous dial so as to prevent reading of the setting.

6) It was reiterated that the green paint on the face of the dial is to be eliminated. [redacted] reported that this had already STAT been accomplished.

7) The torque characteristics of the Sandvick spring and straight spring are to be investigated at low temperatures. The lower operational temperature is to be -40°F.

8) The device is to be fitted so as to fire not only an M-34 detonator, but also a coupling base.

9) [redacted] reported that Thomaston had been directed STAT to bring all drawings for the case up to date. New Haven Clock is to be instructed to do the same.

10) A copy of [redacted] acceptance program is to be STAT delivered to New Haven Clock if not already accomplished.

11) The tolerances for the movement are to be obtained from New Haven. Other clock manufacturers will be contacted to ascertain if these are realistic.

12) Two specifications are to be prepared, one for the movement and one for the case.

13) Concurrently with the investigation for the can for the J-Feder, one for this device will be undertaken. The unit pack is to consist of the device, cocking plug, coupling base, M-34 detonator, shipping plug, adapter, pull wire, instruction sheet, and paint for the dial. It was pointed out that older models included all of these items with the exception of the paint and that the old drawing could serve as a guide.

By [redacted] STAT

/pdw

24 HR.
1-8 Anderson

MEMORANDUM

To: [redacted]

Case: 58214-AB Date: November 23, 1953 Page: 1 STAT

Subject: QK-15-529 Itemization of August Billing

****

On Friday, November 13, [redacted] raised the question as STAT to the reason for the August billing for material in the amount of $9,000.00. It has been ascertained that this figure includes tools from the Thomaston Special Tool Company for two items, one amounting to $8,564.00 and the other for $1,182.00. An additional bill from the Elgin Watch Company in the amount of $72.73 was also rendered.

This cost breakdown was orally transmitted to [redacted] STAT on Wednesday, November 18. He requested that in the future the [redacted] STAT billings itemize material cost. The writer stated that he would look into this and if it were not possible to accomplish it through accounting, that a separate itemized bill could be furnished by this office.

By: [redacted] STAT

/mem

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 70-2

From [redacted] STAT

FORM NO. 101

[redacted]

STAT

Clock Test Program

This memorandum incorporates some of my preliminary ideas on the design of the test schedule for the American made clocks.

Initial Check

The first step will be to check all the clocks as they arrive from the factory at room temperature. These tests will include both reproducibility and timing accuracy.

If the first timing and reproducibility tests show no essential variation by the clocks, put them in order by factory serial number; if the first test shows that there is an essential difference between clocks, put them in order from best to worse by some characteristic such as accuracy, rate, or reproducibility. In either case, number the clocks from 1 to 100. These numbers are used in what follows as the basis for selected clocks for each phase of the test.

Oil Elimination

One of the objectives of this test program is to decide on the proper lubricant to use in the clocks; and, as I understand it, there is a good likelihood that at least one of the alternatives will be eliminated in the cold test. Therefore, I think that it is appropriate that the next step in the test program be to eliminate one of the lubricants. To do this select 24 clocks with numbers given in Table I. The first column headed "Dry" gives the numbers of the six clocks which are t to be run with no oil. The second column headed "As Is" gives the numbers of the six clocks to be run with the oil used at the factory. The third and fourth columns give the test numbers of the clocks to be tested with two alternate types of oil. These 24 clocks will be run through a cold test at sufficiently low temperature to eliminate one of the lubricants from further consideration.

TABLE I

Lube Elimination Test (24 clocks)

Dry	As Is	Alt. #1	Alt. #2
5	9	13	17
21	25	29	33
37	41	45	49
53	57	61	65
69	73	77	81
85	89	93	99

[redacted]

STAT

Lubricate Clocks

Now we have reduced the possibilities to three lubricant conditions - A. Dry, B. As Is, C. - the successful one of the alternative lubricants. There are six clocks which have been prepared with each of these lubricating conditions. Seventy-two more clocks should be oiled as given in Table II, so that there is a total of 30 clocks in each of three lubricant conditions.

TABLE II

Lubrication Schedule
(90 Clocks)

	Dry - A					As Is - B					Successful Alt. - C				
Group	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1 either	or	and:	C2	C3 C4 C5
	5	6	10	14	18	9	11	7	15	19	13	17		8	12 16 20
	21	22	26	30	34	25	27	23	31	35	29	33		24	28 32 36
	37	38	42	46	50	41	43	39	47	51	45	49		40	44 48 52
	53	54	58	62	66	57	59	55	63	67	61	65		56	60 64 68
	69	70	74	78	82	73	75	71	79	93	77	81		72	92 80 84
	85	86	90	94	100	89	91	87	95	1	93	99		88	76 96 2

Temperature Tests

If the J-Feder tests show that there is a noticeable interaction between various sequences of temperature conditions, we should select groups of clocks to be put through five different temperature cycles which provide for every possible combination of temperatures in pairs. These sequences are given in Table III.

TABLE III

Sequences of Temperature Tests

(Subject to Modification by J-Feder Test Experience)

A = 77°
B = -20°
C = +120°
D = Cycle
E = -60°
F = 160°

Groups (Table II)	Sequence
A1, B1, C1	A B C D E F
A2, B2, C2	B D A E F C
A3, B3, C3	C A D F B E
A4, B4, C4	E F B A C D
A5, B5, C5	F C E B D A

Note that there are 18 clocks in each group, six with each of the three lubricant conditions. I believe that it is possible to handle at least 18 clocks in one temperature box at a time.

Storage Test

If, on the other hand, it is decided that an acceptable procedure would be to select a group of clocks and put it through each of the temperature tests in succession, it is possible to use the remaining clocks for the storage test to determine the effects of storage conditions on the lubricant conditions. The sequence to be used would be the first line of Table III, since the highest temperature - which may cause damage - is last. In this case, we would test immediately the 18 clocks in group A1, B1, and C1 from Table II. Table IV shows the numbers of the clocks to be stored under three possible storage conditions, One of these conditions would probably be high temperature and high humidity, a second storage condition may be at room temperature or at possibly very low temperature, and a third possible storage condition might be in a cycling temperature, or salt spray, or prolonged vibration, or other condition of interest.

TABLE IV

Storage (72 Clocks)

STORAGE	I			II			III		
LUBRICANT	A	B	C	A	B	C	A	B	C
HALF MAX.	6	11	13*(17)	42	39	44	78	79	76
	22	27	29*(33)	58	55	60	94	95	96
STORAGE	38	43	45*(49)	74	71	92	18	19	20
	54	59	61*(65)	90	87	16	34	35	36
MAX.STORAGE	70	75	77*(81)	14	15	32	50	51	52
	86	91	93*(99)	30	31	48	66	67	68
	10	7	12	46	47	64	82	93	84
	26	23	28	62	63	80	100	1	2

These clocks would be stored for some period of time. The first four clocks in each column of Table IV (Total 24 clocks) would be tested after perhaps half the maximum storage period. The second four clocks in each column of Table IV would be tested at the end of the maximum storage period. The test temperature sequence would be ABCDEF (Table III).

Clocks for Other Tests

This test program has used up 96 clocks: the six that were originally oiled with the unsuccessful lubricant and thirty oiled with the three competing lubricants. The other four clocks in the sample will probably be used in vibration tests, shock tests, and other tests provided in the test agenda. It is possible to be more economical of clocks on the temperature testing program if it is possible to use the same clocks over again. For example, in the storage test it might be adequate to test a series of clocks at the end of half the storage period, put these back into storage and test them at the end of the storage period. However, running the clocks in this way may have some type of effect on the aging of the lubricants.

Hence, I would suggest that if additional clocks are needed for other parts of the test program, they be taken from the clocks that have already been put through this test program. Thus, there would be 18 clocks available after the initial test, 36 more after the complete storage life test.

Summary

This test program takes into account: a) the effects of the different lubricants both when they are new and after storage under various conditions, and b) the various operating characteristics of the clocks under critical conditions of temperature and humidity. If the storage test is used, it would be necessary to have available one box at a time for each part of the temperature test and three storage boxes large enough to hold 24 clocks. If, on the other hand, it is decided to try the various sequences of temperature conditions on the clocks when they are new, it would be necessary to have available concurrently one box for each of the six temperature conditions, these boxes being large enough to hold 18 clocks at a time.

R. G. Brown
RGB:jhl

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: October 29, 1953 Page: 1
QK-15-529
Subject: Acceptance of Bids from
Thomaston Special Tool Company

****

The following items and costs have been received from Thomaston Special Tool Company:

Item	Tooling	Unit Cost
Cocking device		$ .40
Adapter	$ 110.00	1.60
Positive starter	850.00	1.40

The total cost, including tooling costs amortization, for 1000 units is as follows:

Item	Tooling	Production	Sub Total
Cocking device		$ 400.00	$ 400.00
Adapter	$ 110.00	1600.00	1710.00
Positive starter	850.00	1400.00	2250.00

[redacted] has authorized the above expenditures, and Thomaston Special Tool Company has been given written acceptance of the quotation and authorization to commence production. STAT

With the above prices, it is now possible to get a relatively good estimate of the unit cost of the 24-hour assembly, as follows:

Item	Unit Tooling	Unit Production	Unit Sub Total
Movement	$ 2.90	$ 12.74	$ 15.94
Case	17.56	21.60	39.16
Cocking device		.40	.40
Adapter	.11	1.60	1.71
Positive Starter	.85	1.40	2.25
		Total Unit Cost	59.46

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 70-2

By: [redacted] STAT

/mem

From HFK

[redacted] STAT

FORM NO. 101

Springdale, Ct. Anderson

MEMORANDUM

To: [redacted] STAT

Case: C-58214-AB
QK-15-529
Date: October 21, 1953
Page: 1

Subject: Trip Report

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On Tuesday, October 13th, the writer visited [redacted] to discuss the present status of the AB program. [redacted] had no further comments to make regarding the proposed J-Feder test program, and accepted the writer's decision to obtain testing and evaluation experience on the J-Feder program before committing the AB program to writing. STAT STAT

On Wednesday, October 14th, the writer visited the New Haven Clock and Watch Co., to check on the promised delivery date of October 15th for 100 AB mechanisms to Thomaston Special Tool Co., and also learn as much as possible about points of lubrication in the mechanisms. After some discussion with [redacted], a date of October 23rd or 26th was made for final delivery of the mechanisms; while this is about a week later than originally promised, the writer does not believe New Haven should be criticized in view of their extremely heavy work-load for 1954 automobile accessory production. As regards lubrication problems, the New Haven engineering department was extremely courteous and helpful in giving the writer all help possible in the limited time available. The writer asked that Mr. Denegre obtain fifty 24MM Sandvik curved-section springs for installation in later mechanisms, in anticipation of aging tests to be run in the future. STAT

On Thursday, October 15th, the writer visited the Thomaston Special Tool Co. and talked with [redacted] regarding details and scheduling of the AB cases and assembly. [redacted] stated that we could anticipate delivery of 100 AB assemblies during the third week in November. Thomaston Special Tool Co.'s quotation for tooling and design costs of the positive starter were found to be $850; a verbal acceptance of this quotation was made and [redacted] was authorized to commence work on the starter to obtain completion of the tooling in time for the November delivery. STAT STAT STAT

In summary, the visits described above have satisfied the writer that the AB program is progressing satisfactorily, although more slowly than was originally anticipated.

By: [redacted] STAT

DOC ______	REV DATE ______	BY ______
ORIG COMP 056	OPI 52	TYPE 02
ORIG CLASS M	PAGES 1	REV CLASS ______
JUST ______	NEXT REV ______	AUTH: HR 10-2

From HFK/mem

FORM NO. 101

[redacted] STAT

MEMORANDUM

To: [redacted]
cc

Case: 58214-AB QK-15-529 Date: October 15, 1953 Page: 1 STAT

Subject: Visit with [redacted] STAT

****

During the writer's recent visit with the client, [redacted] STAT
indicated the following changes in the AB program:

1) J-Feder water and vaporproofing was to be abandoned, at least temporarily, since the single anticipated wet-use of the mechanism with the pinup had proved unsatisfactory.

NEW SUBJECT

2) No further steps to obtain an additional packaging machine for this case should be taken. [redacted] said that it was quite possible that no large repeat order would follow the present lot, and that any re-order would probably be in lots of only 1000 units. On this basis, a hand-operated canning machine, for use with mechanical seal cans, would be satisfactory. Mr. DanBrunt now has such a machine. STAT

3) The test agenda for the new AB items shall be sent to [redacted] in the very near future. The writer, however, will await the initial results for the J-Feder tests to determine whether the test mechanisms and techniques are satisfactory, yielding the desired results, before committing the new program to final form. STAT

Since the writer's last visit with the client, the timer has arrived and has been given a preliminary test run. It does everything that was expected; with a reasonable amount of time to develop techniques for testing, it should prove itself well worth having.

The Johnson Company has completed reworking of all J-Feders and all indications are that the work done is satisfactory. One J-Feder had to be partially dismantled and cannibalized to provide miscellanous parts for others.

By [redacted] STAT

/pdw

DOC ____ REV DATE ____ BY ____
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From ....

[redacted] STAT

FORM NO. 101

1 of 2

MEMORANDUM

From: [redacted] STAT

Case No.: 58214 Date: September 15, 1953

To: [redacted] (7)
(1)
(1)
(1)
File (1)

Subject: Minutes of Twenty-Eighth Meeting With Akaphlex Held on September 9, 1953. (Twenty-Sixth Meeting of Client)

****

[redacted] STAT

501 It was stated that more attention should be paid to security in the status reports. It has been noted that various improper code names have been used.

545-AS [redacted] is to visit the Reservation on September 17 to discuss the test agenda with [redacted] At that time he requested that tops and bottoms be on hand for his inspection. It was stated that the paint to be used in the program is available at any time. The September issue of "Modern Plastics" is to be consulted for paint information. STAT STAT

Burial Container

508-G It was reported that all temperature tests at 41°, 77°, and 97°F were either completed or under way. If possible all tests should be completed by October 15. It is realized, however, that the length of the program cannot be determined. For the present the old luting compound tube is satisfactory. However, the temperature and humidity characteristics of the new tube are to be investigated.

Firing device A.C. Delay

529-AB It was reported that the production of the first one hundred watch movements should be completed by the week of September 21.

Firing Dev., Clockwork

525-X The units are to be fired against wood and steel targets with varying angles of incidence to ascertain ricocheting characteristics.

Limpet, Pin-up

522-U When available the neoprene sleeves will be exhibited to [redacted]. It was requested that [redacted] submit a report on the number of production units which had been turned over for testing. Regarding the engineering test report, it was questioned whether the report submitted by [redacted] should be considered a final report or must it be edited by Akaphlex. It was requested by [redacted] that several of the tests be repeated employing 40- and 36-inch drops. [redacted] will witness these tests on September 17. STAT STAT STAT STAT STAT

Firing Dev., R.R. Torpedo

506-E Mr. Bamford is to witness the preliminary tests at the Reservation during the week of September 14.

Grenade, Gas Tank, Small

DOC ____ REV DATE ____ BY ____
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[redacted] STAT

503-B Explosive, Camouflaged

It was decided that the testing of the bread with varying numbers of detonators should be discontinued. [redacted] is to follow up on the coloring of the material and complete the tests on the HF mixture. STAT

518-Q Coal, Explos.

The instruction sheet, a sample of which is to be submitted to the client, is to be included in the camouflage kit. The specifications and drawings are to be expedited.

544-AR Explos., Camouf. Nfpolite

[redacted] is to submit a patent disclosure for the RDX to the proper authorities. This is to be rewritten as a procedure for the preparation of an explosive for submission to Ordnance. Samples are to be prepared with varying degrees of hardness. The substance is to be investigated for dyeing and flex characteristics. The investigation of an aluminized explosive is not to be conducted. STAT

519-R Camouflaging

1) The results of the tests of the head delay incendiary with the rubber bales were reported. [redacted] requested that [redacted] employ two units taped together aimed in opposite directions. It was suggested that a satisfactory recess could be made by employing a cork borer. The recipe for the casein RF mixture is to be rewritten. STAT

2) A kit for camouflaging rocks in the field is to be prepared. Sample bricks are being obtained by Akaphlex and will be forwarded to [redacted] Sample rocks have been requested. In the future the rocks prepared by [redacted] are to be smaller. STAT STAT

502-A Instl., Disp. Combustible

[redacted] is to discuss the program with [redacted] on September 17 after which time [redacted] is to read the old files on the unit. [redacted] requested that we give serious thought to a simple test structure for full-scale tests. It was reported that there are on hand at the Reservation expendable test structures. STAT STAT STAT

514-M Demo Charge, Shaped

The du Pont open-hole charge is to be tested. All data on the firings is to be submitted to the client.

550-AX Tests of Mech. Items by AMP

A summary of all engineering tests completed to date is to be forwarded. A meeting is scheduled for Tuesday, September 29, with the client to re-evaluate the program. It was reported that in the near future there will be a need for more test items.

538-AK Paper, Edible

The specifications for the SE-type paper are to be submitted one month after the end of the production. It was decided that instead of packing the material in cans, metal foil bags should be employed. If the program on the S-type paper does not proceed smoothly in one month, a new supplier will be sought.

523-V Lifting Gas

Fragility tests are to be conducted on a PVA bag filled with lithium hydride at 0°F. It was decided that the temperature and solubility characteristics of a Methocel film should be investigated; however, the PVA film will be further tested to ascertain if it is possible

[redacted] STAT

to reinforce it with a metal scrim. It was decided that enough drawers for a full-scale test should be produced. This test will be conducted when sufficient water is on hand in the Reservation in [redacted] STAT presence.

527-Z It was decided that it would be better to reduce the size of the instruction sheet instead of redesigning the unit pack. [redacted] STAT is to investigate the status of the procurement order of the solution from Federal Laboratories.

535-AH It was stated that the destruction of the animal will be used as the last resort in the program. Incapacitation is the major aim. The pyrophosphoromides are to be the first chemicals tested. Materials such as iron carbonyl and nickel carbonyl are not to be tested due to their high toxicity to man. A list of compounds to be tested is to be submitted to the client for his comments. The compounds are to be tested by 1) atomizing in the animals' face and 2) contaminated material.

510-I Additional closures are to be constructed for test purposes. A complete report on an aluminum container is to be submitted. The use of a teflon coating is to be considered.

504-C The client is to submit a letter to [redacted] STAT commenting on the latest report of [redacted] STAT. The report on the battery test is to be submitted immediately. No further work is to be conducted. A complete report on the case including a financial statement is to be submitted.

515-N A pressure compensation device is to be incorporated in [redacted] STAT new design. The firing mechanism is to be re-evaluated. The use of a smaller bellows is to be investigated. A cost estimate for the immediate program is to be submitted.

528-AA The method for sealing the ampoule is to be settled in order that specifications can be submitted. It was agreed that the present solution would have to be accepted. It was decided that the production lot would be tested at low and high temperatures at the Reservation.

By [redacted] STAT

/pdw

[redacted] STAT

MEMORANDUM

To: [redacted]

c.c.

Case: 58214-AB
QK-15-529

Date: September 9, 1953 Page: 1 STAT

Subject: Trip Report - American Time Products, Inc.

On Tuesday, August 11, 1953, the writer visited American Time Products, Inc., 580 Fifth Avenue, New York 36, N. Y., to see that firm's "Watchmaster" watch timing instrument in use and investigate its applicability to the AB problem.

[redacted] Vice President of the firm, spent about two hours describing and demonstrating the instrument, and discussing time-keeping mechanisms in general. STAT

With regard to the "Watchmaster" model G-17, the instrument itself appears to be quite adaptable to the current AB problems. Of particular interest is the fact that the frequency control unit, a "plug-in", tube encased tuning fork, can be supplied for any frequency between 100 to 10,000 cpm, at a cost of approximately $110.00 each, two week delivery.

The primary limitation of the instrument for our own applications of testing appears to be the maximum temperature of 120°F to which the audio pickup unit may be subjected. This will require a mechanical pickup system for high temperature testing.

This instrument has been ordered, cost of approximately $650.00, and should be delivered by the latter part of September.

By: [redacted] STAT

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ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS A PAGES 1 REV CLASS _____
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From.....HFK/mem.....

[redacted] STAT

FORM NO. 101

MEMORANDUM

Firing Dev. Cl. - 24hr.

For info:

To: [redacted]

cc: J. P. S.
H. M. A.

Case: 58214-AB QK-15-529 Date: August 3, 1953 Page: 1

2744

3 file

Subject: Minutes of meeting on AB clockwork program

STAT

1. The following is a list of action items determined for the AB clockwork at a meeting of [redacted], Thomaston Special Tool Co., [redacted], and H.M.A., H.F.K. for [redacted] STAT STAT

New Haven Watch & Clock Company

a) Remove identification from the barrel bridge plate, and supply two (2) additional plates for the prototypes now in our hands.

b) Enlarge the existing "peep hole" over the escapement wheel to 3/16" diameter, to allow full observation of the luminous spot on the wheel.

c) Place scotch-taped serial number on each movement carrying case as the movement is assembled, for [redacted] inspection and test control. STAT

d) Produce 1025 units, incorporating the above changes.

e) Submit a cost figures for both the movements and tooling at an early date.

Thomaston Special Tool Company

a) Use zinc die casting

b) Bore a guide hole into the case on the centerline of the positive starter spindle, to provide an outboard bearing for the spindle.

c) Using the Leeds and Northrup basic idea, redesign the positive starter as a single stamping of beryllium copper sheet, and fastened to the case with a screw fastener.

d) Redesign plug to allow full threading into case before spindle engages the uncocked firing pin.

e) Enlarge the circular cap on the cocking spindle to 5/8" diameter.

f) Enlarge slots in both pieces to 0.080" width x 1/16" deep.

DOC ____ REV DATE ____ BY ____
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ORIG CLASS M PAGES 2 REV CLASS ____
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From [redacted] STAT

[redacted] STAT

FORM NO. 101

g) Extend adapter firing pin backward so that it will clear the safety by approximately 1/64" when fully screwed into the case.

h) Extend forward movement of the firing pin by 1/8" to allow greater reach into primer cavity.

i) Eliminate all flat surface on the firing pin point; must be sharp.

j) All gaskets to be coroprene of appropriate thicknesses.

k) Quote on 100 J-Feder adapters (leaded brass) and 100 J-Feder shipping plugs (61ST4 or 61ST6 aluminum).

l) Positive starter

[redacted] STAT

a) Design wrench for J-Feder cap and adapter.

b) Get data on instructions for rear plate of clockwork case.

c) Design nitrogen pressure system for testing clockwork cases at Thomaston.

d) Write work orders covering initial production work by Thomaston for positive starter, cocking device and adapter.

[redacted] STAT

HFK/mac

Timing movies 11-473

MEMORANDUM

AUG 4 1953

To: [redacted] STAT

cc: [redacted]

Case: 58214-AB Date: July 21, 1953 Page: 1
QK-15-529
Subject: Machines for Clockwork

The Watch Master Timer is produced by the American Time Products Company, Inc., 580 5th Avenue, New York City. Cost of this unit is $695 less 5%-10 days, delivery one (1) week. [redacted] stated STAT that no special training was necessary to operate this machine. This machine can handle our watch movements in the case by means of extension wires. Literature will be forwarded to us.

The L & R Manufacturing Company, Arlington, New Jersey was contacted on the L & R precision cleaning necessary. They manufacture a wide variety of machines as to size and capacity, so instead of quoting a price, they are mailing us literature so that we can specify the type we desire. This machine is built for 1/5 or one (1) beat per 5 seconds, which is the standard used in the United States Watch Industry. However, if the New Haven movement is not standard the machine can still be used. If desirable, an off-beat machine can be made.

[redacted] STAT

HMA/mac

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From [redacted] STAT

FORM NO. 101

[redacted] STAT

MEMORANDUM

Timing Dev. el.

58214-AB

To: [redacted] Case: QK-15-529 Date: July 21, 1953 Page: 1 STAT

Subject: Telephone Call

A telephone call was made to [redacted] of Thomaston Special Tool Company on July 15, 1953. [redacted] informed the writer that two sample cases were scheduled to leave Rochester, New York this date and would be checked for dimensions. The writer will call on July 24, 1953 for a firm date on delivery of the two prototypes. STAT STAT

A telephone call was then placed to [redacted] to confirm a meeting to review the case. It was decided that it would be more convenient and cheaper for [redacted] to visit here. Formans will also visit during the week of the 26th. [redacted] will be away from the office next week and, hence, not available. STAT STAT STAT

The following points will be discussed during [redacted] visit: STAT

1. The two models will be examined and a decision reached on the watch movement. If satisfactory, New Haven will be informed immediately and a firm price established.

2. The ~~Keefer~~ No decided to use Wilsons positive starter will be used during production.

3. An additional set of drawings will be available for [redacted] STAT

4. Information on the Timing and Washing machine will be evaluated.

5. The Feder clock adapter model will be exhibited and discussed.

6. The status of the Feder "O" rings will be considered.

7. The use of a tear strip can will be considered. Cost of dies for the canning machine will be requested as well as a price for 1100 cans. The extra 100 cans will be necessary as a die will be used for the first time and damaged cans will occur until proper adjustment is reached.

[redacted] stated that a decision was reached during the recent Project Engineers Meeting that existing funds would be used for the Feder repair. Additional funds will be needed later for packaging and any additional funds will be included at that time. STAT

By: [redacted] STAT

DOC _____ REV DATE _____ BY _____
ORIG COMP 05 6 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 10-2

/mem

From HMA

[redacted] STAT

FORM NO. 101

MEMORANDUM

To: [redacted] STAT

58214-AB
Case: QK-15-529 Date: July 21, 1953 Page: 1

Subject: Trip Report

On 23 June 1953, [redacted] STAT visited the New Haven Clock and Watch Company, New Haven, Connecticut and discussed the project with [redacted] STAT stated that New Haven expected to maintain the schedule proposed in a meeting with [redacted] STAT [redacted] STAT. He also stated that the bill for the models would run about $1,700.00 instead of the $300.00 they originally estimated. He was preparing a letter to notify us of the fact and would follow up with a cost breakdown.

[redacted] STAT also visited Thomaston Special Tool Company on 23 June 1953. DeBisschop showed two cases (one of zinc and one of aluminum) that were made from the "soft" die. The cases were checked for dimensions and the only discrepancy found was that the pin had to be moved 0.050". When this change has been made, two additional samples will be prepared and forwarded to Thomaston. Dimensions will again be checked and approval given to harden the die. Two cases will be made, one of aluminum and the other of zinc.

During a meeting in December 1953, it was decided to have the case made of zinc. It is the writer's belief that the case will be zinc, but the use of aluminum should be investigated. Zinc is approximately 2.5 times as heavy as aluminum but is much easier to machine. If one case of each material is made, production problems of each can be discussed, evaluated and a decision made at the time the models are received.

A sample adapter was given to [redacted] STAT, who will incorporate the design for the Feder adapter. We will also check the threads for size and pitch with other component parts. Thomaston is now working on a cocking device.

Wilson's automatic starter was shown to [redacted] STAT who stated that the design was sound and appeared to be cheaper to make. A decision is to be made as to which starter is to be used in the production.

[redacted] stated that the watch movements could be forwarded to Thomaston from New Haven without the three brass pillar screws as these screws had to be removed as they were not needed in the case assembly. New Haven will be informed of this information. STAT

By: [redacted] STAT

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 02
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/mem

From HMA

[redacted] STAT

FORM NO. 101

MEMORANDUM

Mr. Clark
M-915

To [redacted] STAT

Case: 58214-AB Date: 17 June 1953 Page: 1
QK-15-529

Subject: Changes in Specifications for the 24-hour dial.

1. As the result of a visit of [redacted] Chief Engineer STAT of the Canadian Radium and Uranium Company we have contacted New Haven Clock and Watch and made the following changes in the 24-hour dial:

   a) The tolerances on the rough stock size have been changed from ± 0.0008 to ± 0.015, to conform to standard commercial tolerances for brass stock.

   b) The specifications for the white radium luminous paint have been changed to pale green luminous paint, Canadian Radium and Uranium Company, Specification No. 183.

2. Mr. Gorin in talking to [redacted] STAT mentioned that he thought our previous change from a dot to a line for the index on the hour drum was a step in the right direction, and had we not made that change he would have recommended it.

[redacted] STAT

HFK/mac

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From [redacted] STAT

[redacted] STAT

FORM NO. 101

MEMORANDUM

To: [redacted]

STAT

Case: 58214-AB Date: 12 June 1953 Page: 1
QK-15-529

Subject: Telephone conversation with Denegre of New Haven Clock and Watch Co. - 12 June 1953

Denegre of New Haven Clock and Watch called this afternoon and informed us of the following:

1) The two movements have been finished and will be sent to Thomaston this afternoon.

2) The stock for the main springs has been received from Sandsteel, cut into proper sizes and returned to be made into the curved section springs.

3) The order for all the tooling has been placed.

4) Some parts are now being made.

5) It is requested that all correspondence be sent to John Field and in two (2) copies.

6) The changes in the hour disc and 24-hour dial proposed in a letter to Mr. Denegre on 10 June 1953, were confirmed via telephone.

By: [redacted]

STAT

HMA/mac

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 10-2

cc: Mr. John E. Field, Jr., New Haven Clock and Watch

From: [redacted]

STAT

FORM NO. 101

[redacted]

STAT

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: June 11, 1953 Page: 1
QK-15-529

Subject: Request for Additional Funds.

****

The time is approaching when timing and climatic tests will be required for this device. To date no definite program has been outlined; however, it is possible to prepare a tentative cost estimate for the program. Additional funds will be required for the preparation of final specifications and a report. In order that the program continues smoothly, it is felt that additional funds should be requested at this time and a cost estimate is outlined below:

Time and Climatic Tests.	$1,500
Specifications, Dwgs. and Report .	2,000
	$3,500
Arthur D. Little Fee	245
Total	$3,745

By [redacted] STAT

/pdw

DOC	REV DATE	BY	
ORIG COMP 056	OPI 56	TYPE	
ORIG CLASS M	PAGES 1	REV CLASS	
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As of 1 July 1953 meeting with [redacted] leave STAT decided to wait for more realistic proposal at later date, have enough money for now.

From [redacted] STAT

FORM NO. 101

Rework
M-899

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: 8 June 1953 Page: 1
QK-15-529

Subject: Present Status of AB Clockwork Prototypes

1. A call to [redacted] of New Haven and Clock on June 5 determined the following status of the AB prototypes: STAT

   a) [redacted] hopes to have two prototypes completed for Thomaston Special Tool Co.'s pickup on June 15th. STAT

   b) If scheduling of the new curved-section spring from Sandsteel Spring Co., N.Y., N.Y. goes along as planned, one of the two clockwork prototypes will have this spring installed when delivered.

   c) If scheduling of the new spring cannot meet the expected June 15th date, New Haven will install these springs after A.D.L. has had a chance to test the prototypes.

   d) The luminous dials are to be ordered by New Haven upon written authorization of [redacted] in answer to a letter received from New Haven this date. This authorization has been sent. STAT

2. In general, judging from [redacted] enthusiasm during the telephone conversation, it would seem that the project is receiving top priority attention from the New Haven people. While it is a rash statement to make, the writer believes that they will meet or better their latest production commitments. STAT

By: [redacted] STAT

HFK/mac

From: [redacted] STAT

[redacted] STAT

FORM NO. 101

[redacted] STAT

-83-

O
P
Y

May 25, 1953

The New Haven Clock & Watch Company
New Haven 4
Connecticut

Attention: [redacted] STAT

C-58214-AB

Gentlemen:

The following notes will summarize the decisions and commitments made by both your firm and [redacted] during the meeting of May 19th at your office. STAT

Your firm has outlined the following schedule for both the two (2) model clock works and the 1,000 units to follow.

June 26, 1953:	New Haven Clock to deliver two (2) models to Thomaston Special Tool for installation in cases.
July 10, 1953:	[redacted] to comment on and/or approve the clock work models. STAT
August 7, 1953:	New Haven Clock to be completely tooled for production of clock works.
Sept. 15, 1953:	New Haven Clock to deliver to Thomaston Special Tool 100 units for installation in cases. Authorization for continued production of the remaining units to be given at this time.

To expedite the above scheduling, New Haven Clock is hereby authorized to tool and produce the following parts in sufficient quantities to obtain 1,000 satisfactory units:

C
P
Y

MAY 28 1953 STAT

May 25, 1953 M-835

(1) Minute hand, Leeds and Northrup Part #13

(2) Hour disc (drum) Leeds and Northrup Part #14

(3) Luminous 24-hour dial (no part number)

New Haven Clock is authorized to make the following change in the clockwork mechanism:

(1) Double the diameter of the existing time-setting knob.

New Haven Clock is authorized to produce at the discretion of [redacted], sufficient quantities for 1,000 satisfactory units of such parts are are common to both New Haven's standard watch and the subject clockwork. No listing of these parts is at present available. STAT

New Haven Clock is to call to notify [redacted]. when the first two (2) clockwork mechanisms are ready for delivery on or before June 26, 1953. At present, it is anticipated that the Thomaston Special Tool Company will accept delivery of these mechanisms at New Haven at that time for installation in the cases. STAT

The [redacted] representatives present at the meeting received one sample of the luminous 24-hour dial, and will retain this part for further testing. STAT

In conclusion, we would like to express our thanks for the cordial and cooperative spirit shown. We certainly hope too that you will be able to beat the above target dates, and if there is anything we can do to assist you in getting the work done, do not hesitate to call on us.

Very truly yours,

[redacted] STAT

By:

[redacted] STAT

/ae

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: May 5, 1953 Page: 1
OK-15-529

Subject: Telephone Call

On 30 April 1953 a call was made to [redacted] STAT. regarding the delivery of the two models of the revised New Haven movements for the clockwork device. The delivery was promised no later than 1 May 1953. [redacted] STAT stated that the work on the model had been stopped for a higher priority job (six Chevrolet automobile clocks) and would give no estimate when the work would begin again, or when the models might be completed. [redacted] STAT the Chief Engineer, was in Detroit and would not be in his office until Monday, 4 May 1953. The above also means that no action has been taken on the tooling for the 1100 watch movements.

On 4 May 1953, a call was made to [redacted] STAT concerning the models. Denegre stated that New Haven could not touch the models for another month and that no tooling would be started until the models were completed and accepted. Reason given for the delay was the large amount of automotive work.

By: [redacted] STAT

HMA/mac

DOC ____ REV DATE ____ BY ____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS ____
JUST ____ NEXT REV ____ AUTH: HR 70-2

Fr [redacted] STAT

[redacted] STAT

FORM NO. 101

Clockwork
24 hr.

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB
QK-15-529
Date: May 5, 1953
Page: 1

Subject: Telephone Call

On 30 April 1953 a call was made to [redacted]. regarding the delivery of the two models of the revised New Haven movements for the clockwork device. The delivery was promised no later than 1 May 1953. [redacted] stated that the work on the model had been stopped for a higher priority job (six Chevrolet automobile clocks) and would give no estimate when the work would begin again, or when the models might be completed. [redacted] the Chief Engineer, was in Detroit and would not be in his office until Monday, 4 May 1953. The above also means that no action has been taken on the tooling for the 1100 watch movements.

STAT

STAT

STAT

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STAT

STAT

By [redacted] STAT

HMA/mac

DOC		REV DATE		BY	
ORIG COMP	056	OPI	56	TYPE	02
ORIG CLASS	M	PAGES	1	REV CLASS	
JUST		NEXT REV		AUTH:	HR 10-2

From [redacted] STAT

[redacted] STAT

FORM NO. 101

Clockwork
24 hrs.

MEMORANDUM

[redacted]

STAT

Case: 58214-AB Date: April 30, 1953 Page: 1
QK-15-529
Subject: Electrofilm Process

MAY 15 1953

The attached letter has been received from the Pyrene Manufacturing Company, Newark, New Jersey. It is planned to have approximately 24 watches treated this way and tested for performance in the cabinet by C. S. Hatch. A letter will be written to Pyrene informing them of our plans.

By: [redacted]

STAT

HMA/mac

DOC ____ REV DATE ____ BY ____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 2 REV CLASS ____
JUST ____ NEXT REV ____ AUTH: HR 70-2

From [redacted]

STAT

FORM NO. 101

[redacted]

STAT

Clockwork 24 lbs.

C O P Y

PYRENE MANUFACTURING COMPANY

560 Belmont Avenue

Newark 8, New Jersey

Metal Finishing Division
10 Empire Street
Newark 5, New Jersey

April 20th 1953

MAY 1953

STAT

Attention Mr. C.S. Hatch

Dear [redacted], C-58214-AS

STAT

As per your letter dated April 6th we are pleased to enclose herewith technical information regarding Electrofilm Lube-Lok, the permanent, solid, film dry lubricant.

As to your inquiry regarding the possibility of Electrofilm Lube-Lok application to pocket watch movements, please be advised that we have been carrying on extensive development work for such firms as Telechron Inc. Seth Thomas Clocks, General Time Corporation, Stromberg Time Corporation and Westclox Division of General Time Corp.

Regarding the performances to be expected to be obtained over a wide temperature range, Lube-Lok is recommended to operate from -120°F up to 1000°F, and in some specific applications, up to 2000°F.

As to our being able to estimate a cost for the processing of 100 pocket watches, it is herewith suggested that you forward one to the writer's attention, together with a letter fully describing all the parts you are interested in having so treated, and after visual examination of same, we shall be in a more wholesome position to issue you a firm, sensible quote.

From its many other advantageous uses the writer can see no reason why Electrofilm cannot be applied to pocket watches.

We are looking forward to hearing from you in this regard and suggest you address your further correspondence for the writer's attention. Thanking you for your interest, and soliciting early receipt of your reply, we are,

Yours very truly,
PYRENE MANUFACTURING COMPANY

/S/

Manager, Process Development
Metal Finishing Division

[redacted]/es

STAT

ENCL.

Clockwork

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: April 10, 1953 Page: 1

Subject: OK-15-529
Eight day movement

During [redacted] visit on 8 April 1953, he stated that he would like to have us procure an eight day movement from the Waltham Watch Company. The purpose of this purchase is to estimate how much redesign would be necessary to incorporate this movement into the present case, if possible. STAT

By: [redacted] STAT

HMA/mac

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS A PAGES 1 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 10-2

From [redacted] STAT

FORM NO. 101

[redacted] STAT

MEMORANDUM

STAT

To [redacted]

Case: 58214-AB QK-15-529 Date: March 26, 1953 Page: 1

Subject: Report from [redacted] STAT

The attached letter was received from [redacted], Leeds and Northrup Company, Philadelphia, Pennsylvania. The writer is not in accordance with several of Mr. Wilson's comments for the following reasons: STAT

(1) Instead of six of the watches with polished shafts and jeweled balanced staffs being tested, it is recommended that fifty watch movements from the New Haven production be tested in the cabinets since the units will be jeweled. [redacted] has given his verbal approval. In our last meeting at New Haven, it was agreed to make all the parts but only assemble 20 units. This will be amended to assemble 70 units and hold the remaining parts until testing be completed. At this time, it can be determined whether the friction reduction is sufficient or whether the driving torgue of the main spring must be increased. STAT

(2) The writer is in agreement with [redacted] that satisfactory results cannot be obtained from unaltered standard watch movements. STAT

(3) Based on the client's thoughts regarding ultimate use of this unit, the ± 8 minute tolerance would not be acceptable. A -0 tolerance is extremely desirable and should, if possible, be obtained.

(4) The writer was equally disturbed that Elgin N22a could not be tested. Elgin Watch Company was contacted regarding their oil and informed us that Gulf Oil Company made the oil for them. Gulf Research Laboratories, Harmarville, Pennsylvania informed us that they no longer planned to manufacture this oil, as the specifications were very difficult to follow and practically impossible to meet when tested in compliance with the same specifications. For this reason Elgin N22a was not included in the oils tested. Our Purchasing Department did receive two oils which Gulf felt might help us. These oils were tested and found unsatisfactory.

(5) [redacted] of Thomaston has been able to incorporate a positive starter into the case without changing the die casting of the body. We are expecting a drawing of the starter from [redacted] in a few days and will forward a copy to Mr. Wilson. Thomaston is also preparing two models each of the cocking device and adapter. One complete set of units will be forwarded to [redacted] for his approval prior to a general meeting. The model watch movements are expected from New Haven in two weeks. STAT STAT STAT

DOC ____ REV DATE ____ BY ____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 2 REV CLASS ____
JUST ____ NEXT REV ____ AUTH: HR 70-2

From [redacted] STAT

[redacted] STAT

FORM NO. 101

Copies of [redacted] comments have been sent to New Haven Clock and Watch Company and Thomaston Special Tool Company. As yet, no comments from New Haven have been received regarding the tentative specifications on the movement. STAT

Once [redacted] has evaluated the complete unit, an attempt will be made to arrive at a set of more permanent specifications. STAT

By: [redacted] STAT

HMA/mac

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: March 23, 1953 Page: 1
QK-15-529
Subject: Cost Estimate

Listed below are the cost estimates from New Haven Clock and Watch Company, New Haven, Connecticut and Thomaston Special Tool Company, Thomaston, Connecticut:

Clock Movement (New Haven)		
1100 units at $15.64 each		$17,204.00
Positive Starter (Thomaston)		
Tooling		$3,750.00
1002 units at $4.25 each		$4,258.50
Adapter (Thomaston)		
Tooling		$910.00
1050 units at $1.28 each		$1,344.00
Cocking Device (Thomaston)		
With Threads		
Tooling		$125.00
1050 units at $0.90 each		$945.00
Without Threads		
Tooling		$60.00
1050 units at $0.23 each		$241.50

New Haven Clock and Watch Company's letter of March 13, 1953, did not break down the cost as to tooling and unit cost. Due to the difficulties encountered in obtaining the quotation, it was decided by the writer to place a purchase order before requesting this breakdown of cost.

The prices on the adapter, cocking devices, and positive starter were obtained by telephone and are to be confirmed by letter from Thomaston Special Tool Company.

The cocking device can be made with or without threads. Samples of each are now being prepared. It is recommended that no decision be made on this unit until the samples are available for evaluation.

The total cost for all units would be as follows:

Positive Starter	$8,008.50
Watch Movements	$17,204.00
Adapter	$2,254.00
Total	$27,466.50

If the cocking device would be included the cost would increase either $1,070.00 or $301.50 depending on the type unit desired.

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 4 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 70-2

From: [redacted] STAT

FORM NO. 101

[redacted] STAT

It is recommended that the purchase order for the movements be initiated [redacted] has given verbal approval on 23 March 1953). Additional funds will be requested for the other units in addition to requests for surveillance and packaging programs. STAT

By: [redacted] STAT

HMA/mac

C
O
P
Y

THE NEW HAVEN CLOCK AND WATCH CO.

NEW HAVEN 4, CONN.

March 13, 1953

[redacted] STAT

Dear Harry:

In connection with the production of 1100 L & N 24 Hour Movements, we have progressed far enough with our Models to give you an estimate of the sale price of the units in quantities of 1100 pieces. On a small run of this quantity, our charge per unit would be $15.64 each.

Our Engineering data and methods have not been completely finished, and for this reason we reserve the right to revise this price in the future. The above prices are quoted with our usual terms of Net 30 days, shipment F.O.B. our platform.

Very truly yours,

THE NEW HAVEN CLOCK AND WATCH COMPANY

/S/

[redacted] Jr. STAT
Contract Division

JEF/my

C
O
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C
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THOMASTON SPECIAL TOOL COMPANY

271 East Main St. - Thomaston, Conn.

March 20, 1953

STAT

Gentlemen:

We are submitting the following quotation in accordance with your recent request.

Automatic Starter	Tools	$3,750.00
	Parts	4.25 each
Adapter	Tools	910.00
	Parts	1.28 each
Cocking Device without threads	Tools	60.00
	Parts	.23 each
Cocking Device to Leeds & Northrup Print #8684	Tools	125.00
	Parts	.90 each

Very truly yours,

Thomaston Special Tool Company

/S/

Frank DeBisschop

P

C
O
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Y

MEMORANDUM

To: [redacted] STAT

58214-AB
Case: QK-15-529 Date: February 24, 1953 Page: 1

Subject: Progress Report on Temperature Testing of Clockwork

This testing was conducted to determine which of a given group of lubricants would produce the most satisfactory and reliable results over a particular temperature range when used in ordinary pocket watches.

To accomplish the testing, thirty New Haven pocket watches, arranged in five sets of six watches per set, were supplied. Each set was lubricated with a different lubricant except for a "control" set which contained no lubricant. Each watch was numbered and encased in a thin transparent polyethylene envelope. This was intended to seal the watch against moisture and dust particles. Attached to each envelope was a tag stating the number of the watch and the lubricant with which the watch was serviced.

Prior to commencing the testing, the watches were removed from the plastic envelopes by the undersigned for the following reasons:

1. The envelopes were used to approximate ideal conditions. When the watches are placed in actual use, conditions somewhat less than ideal will be in force.

2. During the winding process the ridged rim of the stem cap would chew and tear the thin plastic, thus nullifying any protective qualities the plastic envelopes would have originally afforded.

3. Contrary to expectations, the plastic envelopes were not airtight. The air inside the envelopes could be squeezed out and the envelopes set aside for a few minutes, at the end of which time an examination of the envelopes showed that they again contained air, evidently "inhaled" from the outside.

4. The tests were all to be conducted in cabinets in which both temperature and humidity could be closely controlled. It was felt that the cabinets could control the moisture and dust content of the atmosphere to a better degree than could the envelopes.

The manner in which the units were tested is as follows:

Each watch was wound, set to the correct time as exhibited by a master clock, hung in an upright position on a panel, and placed in a controlled temperature cabinet. After a 24 hour period had elapsed, the watches were compared with the master clock to determine their respective rates. "Rate" may be defined as the time, in minutes, that each watch varies from the master clock during the 24 hour test period. The rate can obviously be either plus or minus, denoting either a fast watch or a slow one.

From [redacted] STAT

FORM NO. 101

[redacted] STAT

After the rate had been recorded, the watches were again wound, set, and subjected to another 24 hour test. This process was repeated at various temperatures until completion of the testing.

The watches were subjected to three 24 hour tests, with the exception of the first 70° F test which was of only 48 hour duration, at each of the following temperatures: 70°F, 0°F, -20°F, -30°F, -40°F, 70°F, 120°F, 140°F, 154°F and finally again at 70°F. Except for the below freezing temperatures, a relative humidity of approximately 22% was maintained during all tests.

The results of the testing are set forth in Table I, a tabulation of the average rate of each watch for each test temperature. The average rate was arrived at by calculating the arithmetic mean of the three test rates at each temperature.

The number 1's enclosed in parentheses which appear in the temperature columns adjacent to the rates denote that only one temperature test was used to arrive at that particular rate. During the other two tests at that temperature the watch stopped before completion of the tests.

The other figures which appear frequently in the low temperature columns denote the approximate length of time in hours that the watch ran before stopping.

The results indicate that for the extreme temperature range to which a watch might be subjected, either an unlubricated watch or one which had been oiled with Myvolube A Oil would be most satisfactory.

Several things were noted during the progress of the test -

1. Watches wound easily at low temperatures but were stiff and hard to wind at high temperatures.
2. One crystal dropped off during the 120°F test. Nearly all crystals became loose in their retaining rings.
3. Moisture condensation was not evident at any time during testing.
4. Throughout the high temperature testing the watches had a slight oily feel.
5. During the high temperature testing the watch crystals work on a definite yellowish cast.

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPT 5d TYPE _____
ORIG CLASS _____ PAGES _____ REV CLASS _____
JUST _____ NEXT REV _____ AUTH: MR 70-

CSH/mem

STAT

TABLE I
Average Rate (+ min. in 24 hrs.)
AT

Lubricant	Watch	70°F	0°F	-20°F	-30°F	-40°F	70°F	120°F	140°F	154°F	70°F
Nye Clock Oil	1	-1	-3	-31	-47	7 hrs.	-1	-2	-2	-3	-2
	2	-2	-14(1)	-58	-79	11 "	-3	-6	-9	-12(1)	-8
	3	OT	+3	-50	19 hrs.	1 "	+1	-1	-1	-1	+1
	4	-1	-8	-68(1)	-82(1)	1 "	OT	-1	-1	-1	-1
	5	+2(1)	+1	-7	-10	-25	OT	OT	OT	-1	-1
	6	-3	+2	-23	-32	21 hrs.	-2	-3	-3	-4	-3
Myvolube A Oil	9	-2	-2	-7	-7	-8	-2	-4	-6	-6(1)	-6 (1)
	10	-1	-13	-66	2 hrs.	1 hr.	-3	-3	-4	-4	-4
	11	OT	+2	+1	+1	-2	+1	-1(1)	-1(1)	-2(1)	-1
	12	OT	+2	+3	+2	-30	19 hrs.	-1	OT	OT(1)	+1
	13	OT	+2	+1	+1	-14	+1	OT	-1	OT(1)	+1
	14	-6	-1(1)	-8	-12	-27	-2	-3	-3	-8	-7
No Oil	17	-4	-8	-7	-11(1)	2 hrs.	-6	-9	-10	-8	-23
	18	+1	+4	-3	-5	-6	+3	+2	+2	+3	+4
	19	-2	-1	-15	-38	1 hr.	-2	-3	-3	-3	-4
	20	-2	-1	-9	-27	5 hrs.	-2	-3	-3	-3	-2
	21	OT	+1	-3	-6	-2	+2	+2	+2	+3	+1
	22	-1	+1(1)	-11	+1	-4	+1	+1	-1	+1	+1
Micro-bearing Oil	25	-2	-13	-55	1 hr.	1 hr.	OT	OT	-1	-2	-1
	26	-1	-3	-11	-88	2 hrs.	OT	-1	-2	-3	-1
	27	+1	-2	-18	-135(1)	2 hrs.	+1	OT	-2	-2	OT
	28	-4	-11	-36	8 hrs.	1 hr.	-4	-3	-3	-6	-7
	29	-12	-19	-43	-21(1)	1/4 hr.	-13	-13	-11	-12	-13
	30	-3	-12	-33	14 hrs.	1/2 hr.	-3	-4	-4	-7	-4
Special Instrument Gulf Oil	33	-4(1)	-7	-16	-47	9 hrs.	-4	-6	-4	-5	-6
	34	-1	+1	-2	127hrs.	18 hrs.	OT	-1	-1	-2	-1
	35	-2	-15	-29	-66	15 hrs.	-10	-11	-16	-15	-26
	36	-2	-2	-3	-50	1 hr.	-3	-3	-3	-3	-3
	37	-2	-3	23 hrs.	22 hrs.	1/4 hr.	-2	-2	-1	-1	-2
	38	-3	-1	-8	-30	9 hrs.	-3	-7	-7	-8	-6

MEMORANDUM

To: [redacted] STAT

Case: 58214-AB Date: February 9, 1953 Page: 1
QK-15-529
Subject: Trip Report

On February 5, 1953, the writer visited the Thomaston Special Tool Company, Thomaston, Connecticut.

[redacted] showed the model of the positive starter that he had made. Thomaston had tried this starter several hundred times and the unit had always worked. The writer brought back the sample unit made by Thomaston. This is to be returned in the near future. Using Thomaston's design, not only has one part of the case been eliminated, but no other part of the case has to be changed. STAT

During the visit, it was decided that upon completion of the complete models, that samples of the cocking plug and adapter would also be available. The cocking plug samples would include two of [redacted] designs, as well as two of Thomaston's designs. At that time, drawings would be available. It is interesting to point out that the only difference between the two cocking plug designs, is that Mr. Wilson's unit would screw into the case, where Thomaston's would not. STAT

Upon completion of all the items, a decision would be made and approval would be given, so that production might begin. In the meantime, [redacted] STAT would forward cost estimates of the adapter and cocking plug, so that prior approval may be obtained to begin production. Mr. [redacted] STAT has completed drawings of all individual pieces of the case. However, it was felt that it would be best not to distribute any copies of these drawings until approval of the prototypes were obtained.

[redacted] pointed out that part of the tooling was completed. It STAT was agreed that the tooling cost would be billed to [redacted] STAT in two parts.

By: [redacted] STAT

HMA/mac

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 302
ORIG CLASS M PAGES 1 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 10-2

From [redacted] STAT

FORM NO. 101

MEMORANDUM

To: E. [redacted] STAT

Case: 58214-AB
QK-15-529
Date: February 9, 1953
Page: 1

Subject: Trip Report

On February 4, 1953, the writer visited the New Haven Watch and Clock Company, to inquire the status of the cost estimate of the watch movement. It was explained by [redacted], that there was considerable congestion in the Engineering Department and that he wished the writer to talk with [redacted] the new Executive Vice-President of the concern. STAT STAT

[redacted] was formerly with an electronic organization located on Long Island and had worked with the Client's predecessor, during the last war. He intimated that he was dissatisfied with the progress of the present job and that he would personally see that all the requests of [redacted] will be fulfilled in the near future. STAT STAT

He had a luncheon engagement with [redacted] the Chief Engineer and one of the items planned to discuss was this particular unit. The future action of the project concerning New Haven is that within a few days, [redacted] would like to have [redacted] and the writer visit him in New Haven, at which time he would go over their setup and go into detail on the conduct of the project. STAT STAT

It is his hope that this can be accomplished during the week of February 8, 1953.

By: [redacted] STAT

HMA/mac

DOC _____ REV DATE _____ BY _____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 1 REV CLASS _____
JUST _____ NEXT REV _____ AUTH: HR 70-2

From [redacted] STAT

FORM [redacted] STAT

MEMORANDUM

turning rec., clockwork

From:

To: [redacted]

cc:

Case No.:

Subject: 58214-AB

Date: January 26, 1953

STAT

The attached sheet was given to the writer by [redacted], of Thomaston Special Tool Company, Thomaston, Connecticut during his recent visit. The sheet is a summary of materials needed by him for the construction of 1000 cases.

STAT

It would be appreciated if this request would be expedited through the regular channels.

By: [redacted]

STAT

HMA /mac

end.

DOG _____	REV DATE _____	BY _____	
ORIG COMP 056	OPI 56	TYPE 02	
ORIG CLASS M	PAGES 1	REV CLASS _____	
JUST _____	NEXT REV _____	AUTH: HR 70-2	

[redacted]

STAT

B & B 4-52 12M

MEMORANDUM

CONFIDENTIAL

From [redacted] STAT

To: [redacted]

Case No.: 58214-AB Date: January 5, 1953

Subject:

In reference to [redacted] letter dated 24 December 1952, the STAT following actions have been taken:

(1) Thomaston has started tooling up for all componets of the case, with the exception of the self starter. Thomaston's estimate for the tooling up period is approximately four months. No granules are to be included in the case.

(2) A sketch of the self starter has been forwarded to [redacted] of STAT New Haven Watch and Clock Co., [redacted] of Leeds and Northrup Co., STAT and [redacted] of the clients staff. Comments have been requested from STAT all sources. The first two prototypes will include A positive starter.

(3) The tentative acceptance specifications have been forwarded to Dan Brunt and Wilson. [redacted] also has a copy and will forward his comments. STAT

(4) The tentative design of the recocking plug has been discussed with Thomaston, who will submit a quotation for 1000 units. This quote will also include three prototypes; one of each prototype will be sent to Wilson, Dan Brunt, and the writer.

(5) Thomaston's quote on the change in adapter thread will be included in his original quote.

(6) [redacted] proposed test agenda has been received. Tests at room temperature STAT have been completed at New Haven and results are being forwarded.

[redacted] will review the agenda on January 6, 1953. STAT

Five types of lubricants have been supplied to New Haven and watches oiled. Information on the electro-film process has been requested through several sources, i.e., Thomaston Special Tool Company, [redacted] STAT and [redacted] All information received will be forwarded STAT to the client.

DOG ____ REV DATE ____ BY ____
ORIG COMP 056 OPI 56 TYPE 02
ORIG CLASS M PAGES 2 REV CLASS ____
JUST ____ NEXT REV ____ AUTH: HR 70-2

CONFIDENTIAL

[redacted] STAT

B & B 4-52 12M

MEMORANDUM

CONFIDENTIAL

From: H [redacted] STAT

To: W.

Case No.: 58214-AB Date: January 5, 1953

Subject:

(7) The contractor will quote on the movements before completion of the two hand made models. After installation in the cases, Wilson will evaluate the models and forward to the Reservation, where preliminary testing by Stowe will begin.

(8) Twenty units will be made upon completion of the tooling. These units will not only insure that the tooling is correct, but will serve as the initial test lot for evaluation.

(9) Wilson is in possession of the Feder clock. His comments should be available soon. Stowe will forward a test agenda to the client on these units.

By [redacted] STAT

HA/mac

B & B 4-52 12M

CONFIDENTIAL

[redacted] STAT